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Fur Seal Investigations, 1983

Edited by
Patrick Kozloff

March 1985

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

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March 1985

ABSTRACT

Northern fur seal, Callorhinus ursinus, research in 1983 was conducted on the Pribilof Islands and Bogoslof Island in Alaska and on San Miguel Island and nearby Castle Rock, California.

Estimates made of the number of pups born in 1983 on the Pribilof Islands indicate a continuing decline in the number of northern fur seals there.

Censuses of juvenile males on the hauling grounds of St. George Island. from 1978 to 1983 show a general decline in their numbers.

In 1983, 408 pups were born in Adams Cove on San Miguel Island, representing a 60% decrease from the 1982 count of 1,029, an apparent effect of the El Nino.

The existence of a breeding and pupping area an Bogoslof Island was confirmed in 1983.

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INTRODUCTION

by

C. W. Fowler and Patrick Kozloff

The United States, Canada, Japan, and the Soviet Union cooperatively carry out research on the northern fur seal, Callorhinus ursinus, on land and at sea under the Interim Convention on the Conservation of North Pacific Fur Seals. As part of the U.S. obligations under this agreement, scientists from the National Marine Mammal Laboratory in Seattle, Washington, have conducted annual surveys and studies on U.S.-owned islands, particularly the Pribilofs in Alaska and San Miguel off southern California, used by fur seals for breeding and hauling out. This report summarizes the research carried out on these islands in 1983 and served as the U.S. contribution to the 27th annual meeting of the Standing Scientific Committee of the North Pacific Fur Seal Commission in Moscow in 1984.

The Pribilof Islands of St. Paul (Fig. l), St. George (Fig. 2), and Sea Lion Rock (Fig. 1 - Sivutch) are host to an estimated 871,000 northern fur seals. Two additional colonies containing a few thousand northern fur seals breed on U.S.-owned San Miguel Island and nearby Castle Rock off southern California (Fig. 3).

Approximately 25,000 juvenile male fur seals (primarily 3- and 4-year-olds) are currently harvested commercially each year from the hauling grounds of 14 rookeries on St. Paul Island. A total of 500 males were taken on St. George Island for local use as food in 1983. A moratorium on the commercial harvesting of male seals from the hauling

grounds of five rookeries on St. George Island was Imposed beginning in 1973 to permit research on a population as it reverts to its natural state. Fur seals are not harvested on San Miguel Island, Castle Rock, Ardiguen Rookery on St. Paul Island, South Rookery on St. George Island, or on Sea Lion Rock. However, some of the young male seals from the latter three places are known to haul out elsewhere and may be subjected to harvesting. There are four extinct rookeries on St. Paul Island (Fig. 1) and one on St. George Island (Fig. 2).

Terms having special meanings in northern fur seal research are described. in the glossary, as are English translations of Russian names given to some of the rookeries of the Pribilof Islands following their discovery by Russian fur hunters in 1786.

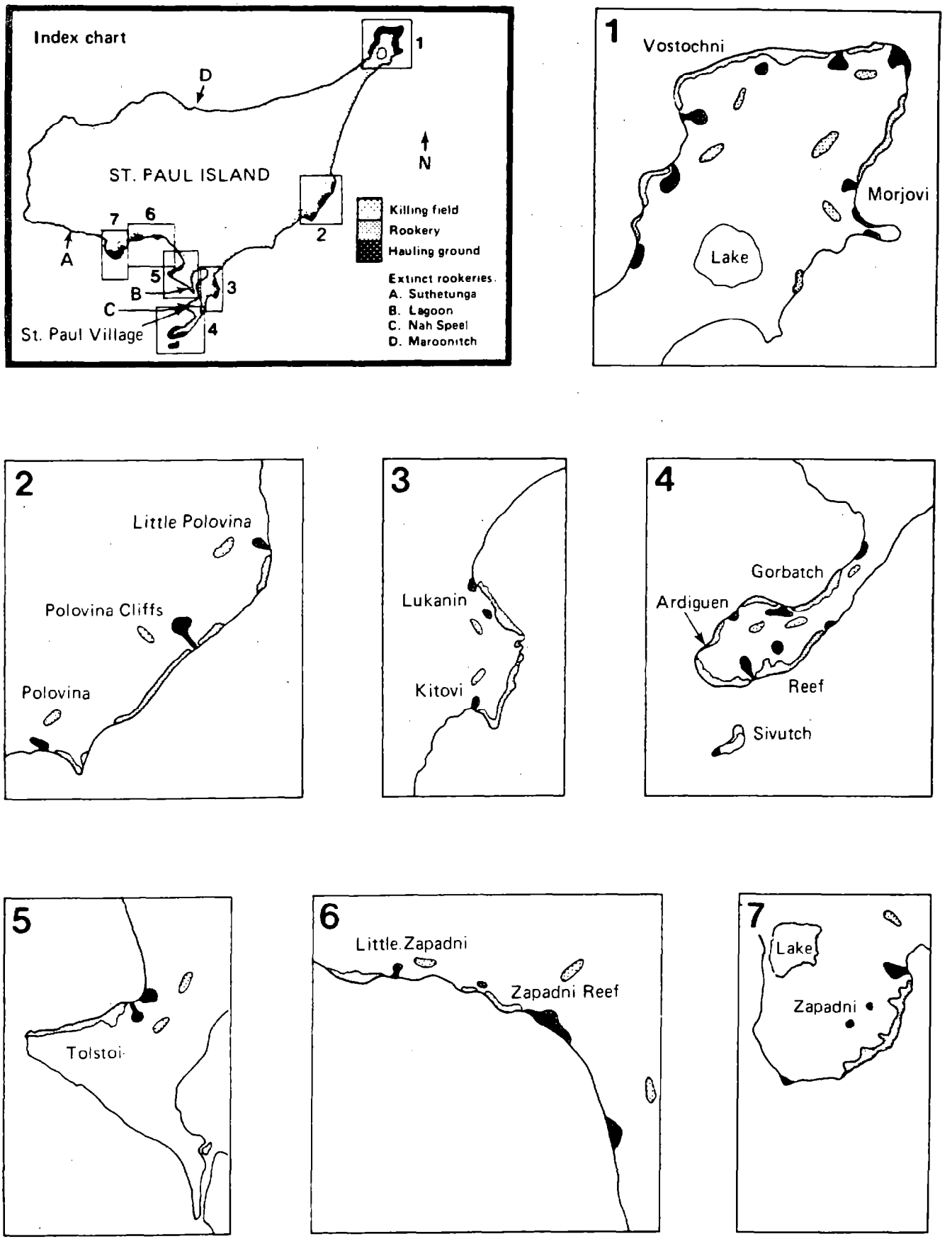
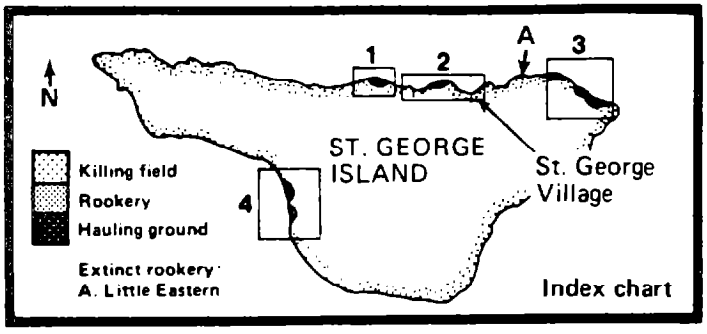
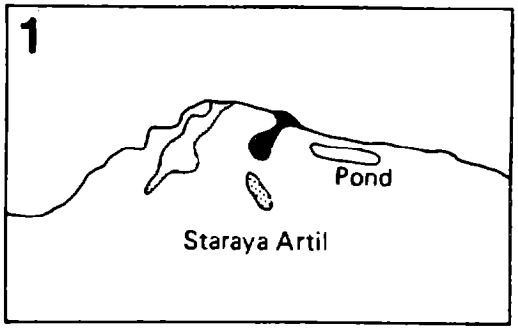
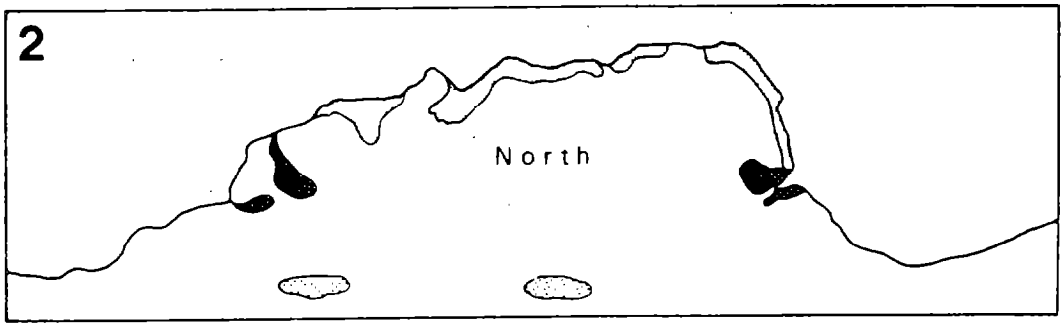
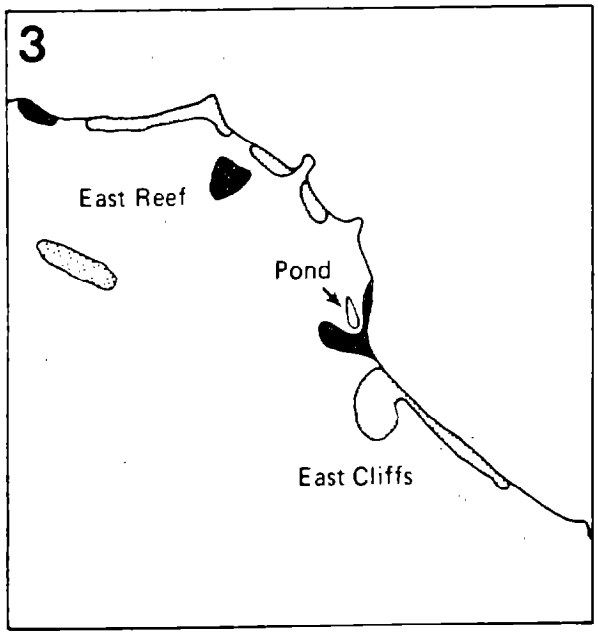


Figure 1 .--Location of northern fur seal rookeries (present and extinct), hauling grounds, and -harvesting areas', St. Paul Island, **Alaska.**









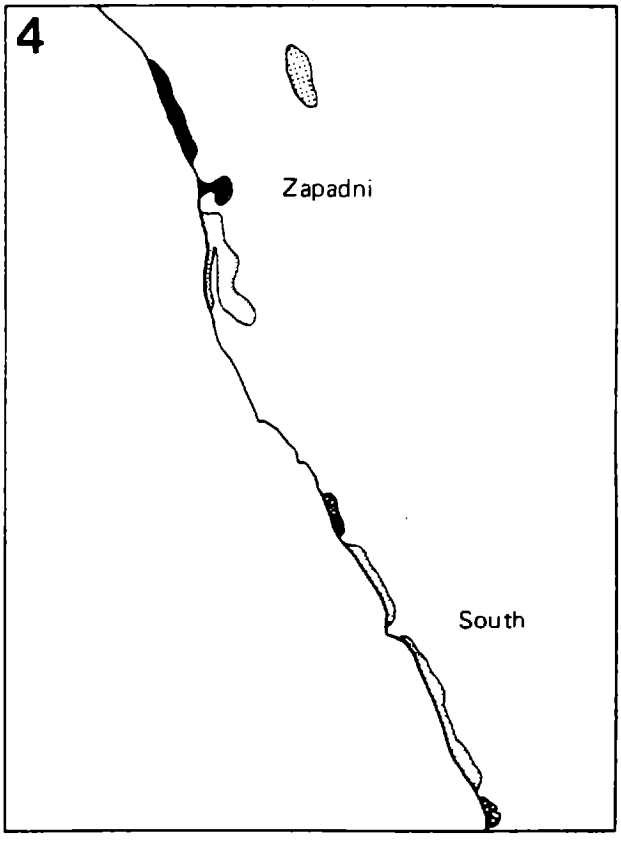


Figure 2.--Location of northern fur seal rookeries (present and extinct), hauling grounds, and harvesting areas, St. **George** Island, **Alaska.**

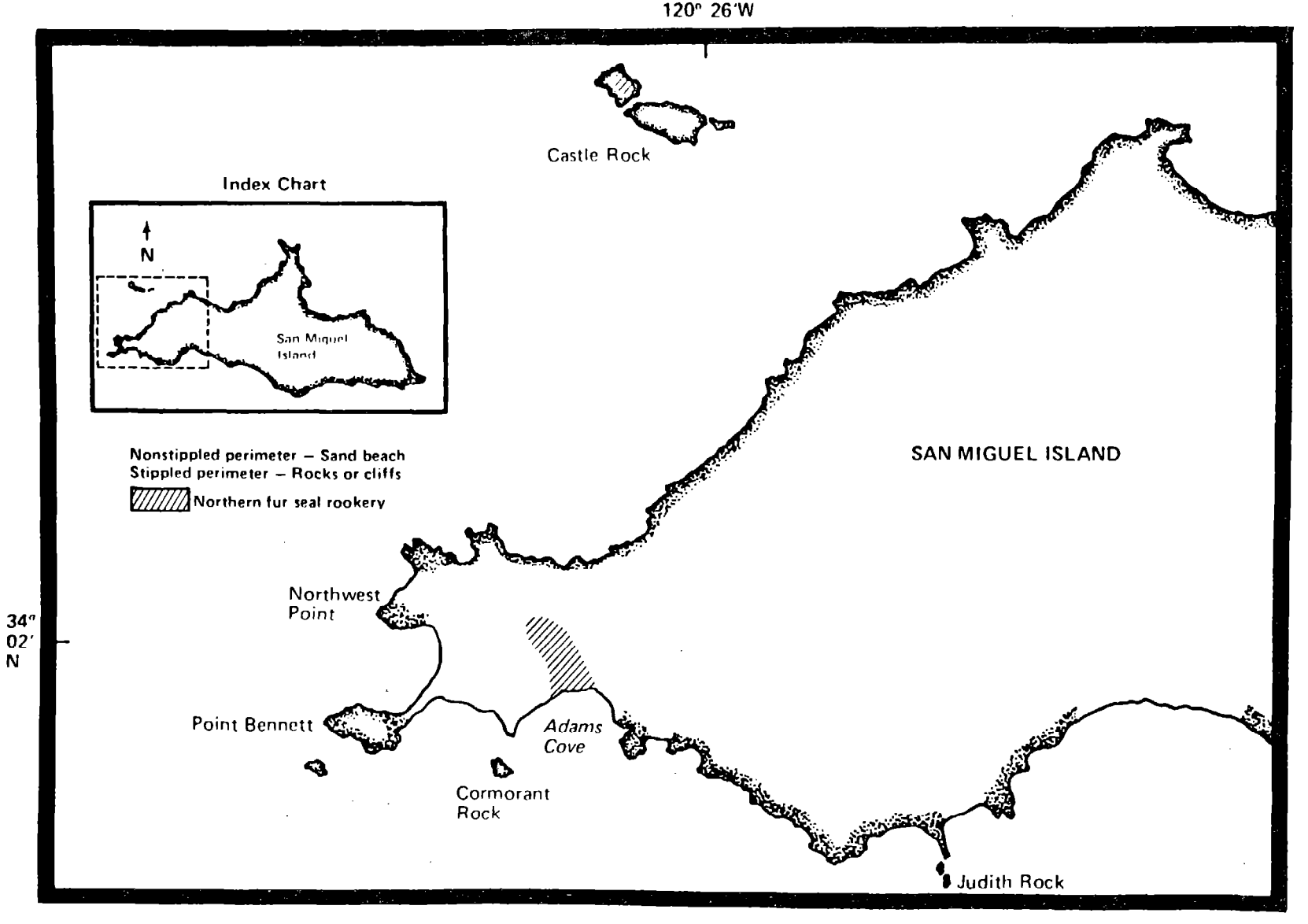


Figure 3.--Location of northern fur seal breeding colonies, San Miguel Island, California.

POPULATION ASSESSMENT, PRIBILOF ISLANDS, ALASKA

by

Patrick Kozloff, Anne E. York, and Joe Scordino

In accordance with the provisions of the Interim Convention on Conservation of North Pacific Fur Seals, the National Marine Mammal Laboratory monitors the status of the northern fur seal, Callorhinus ursinus, herd on the Pribilof Islands through the collection of specific kinds of information on population size, age and sex composition, and natural mortality. Information is also gathered by personnel of the Pribilof Island Program[1] on the number of seals appearing in the commercial harvest on St. Paul Island that are entangled in fishing net fragments and in other debris.

Population Parameters

'Herd elements monitored on the Pribilof Islands in 1983 included 1) age and sex composition of seals harvested on St. Paul Island, 2) number and sex of seals taken for food on St. George Island, 3) number of live adult males and pups, and 4) number of dead pups and older seals.

Age and Sex Composition of Seals Harvested

Males--All male seals with a body length of 49 inches (124.5 cm) or less from tip of tail to tip of nose appearing in the drives from the hauling grounds on St. Paul Island were harvested from 5 July to

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5 August. The age composition of these animals was determined from a 20% sample of maxillary canine teeth collected in each harvesting area (Appendix Tables A-l and A-2). Seals were not harvested on Saturdays or Sundays, and seals identified as females were rejected.

Figure 4 shows the number of 3- and 4-year-old males taken in 1983, and the sizes of the year classes of male seals harvested since 1969 are shown in Figure 5 and Table 1. The age composition of males harvested on St. Paul Island since 1974 is shown in Table 2.

On St. George Island, 500 male seals were taken for food from 21 June to 26 August without restrictions on the size or sex of the animals. The seals harvested were from the east hauling ground of North Rookery. The ages of the seals are given in Table 3.

Females--A few young females through 4 years of age are inadvertently taken during the commercial harvest of males on St. Paul Island and during the harvest for food on St. George Island because of their similarities in size and whisker (vibrissae) color with 3-year-old males. In 1983, a total of 40 females on St. Paul Island were harvested. The maxillary canine teeth and reproductive organs of some of those taken were collected for age and reproductive studies.

Living Adult Male Seals Counted

In 1983, 4,827 harem and 4,242 idle adult male fur seals (bulls) were counted on St. Paul Island from 9 to 21 July (Appendix Tables A-3 and A-4). Appendix Table A-5 lists the number of adult males counted on the Pribilof Islands in mid-July since 1974. Figure 6 illustrates the relative location of the different classes of adult males on a typical fur seal rookery-hauling ground complex.

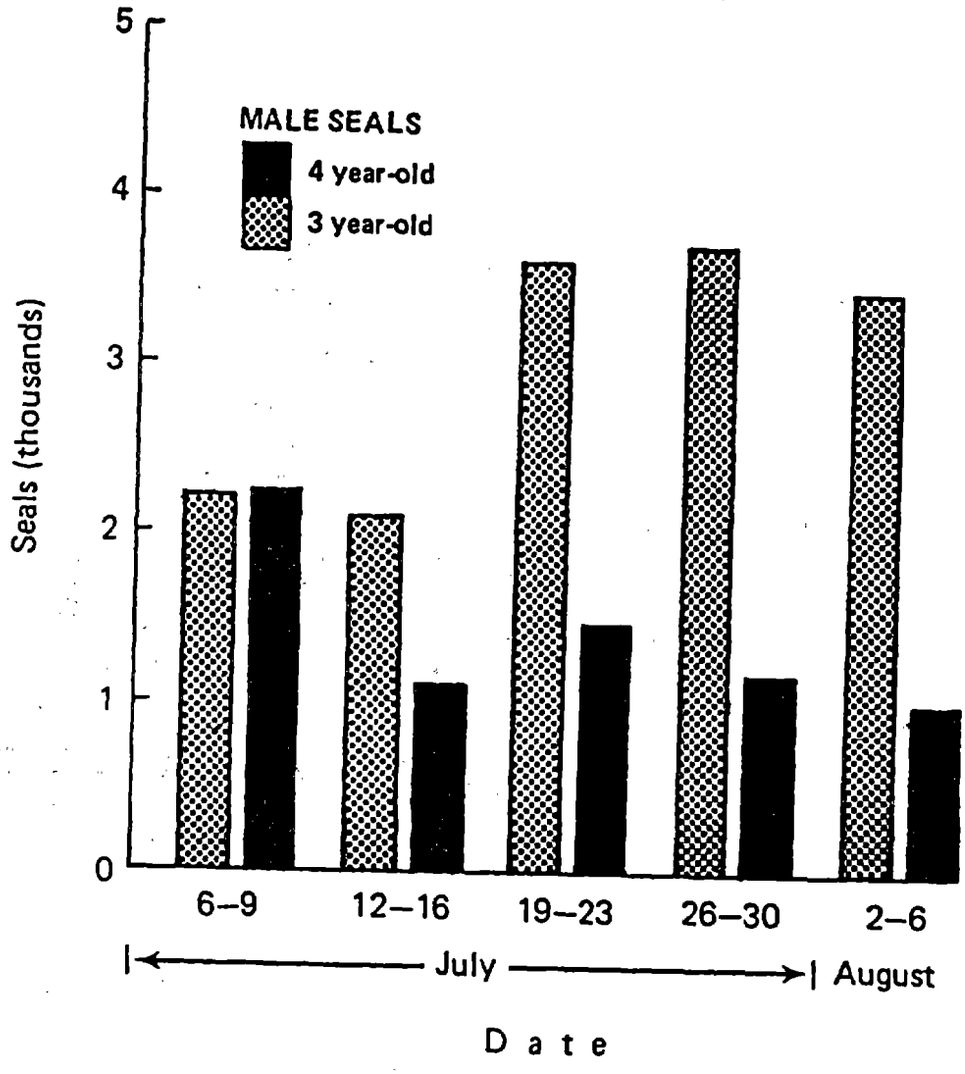

Figure 4.--Number of 3- and 4-year-old male nothern fur seals harvested, St. Paul Island, Alaska, 5 July to 5 August 1983.

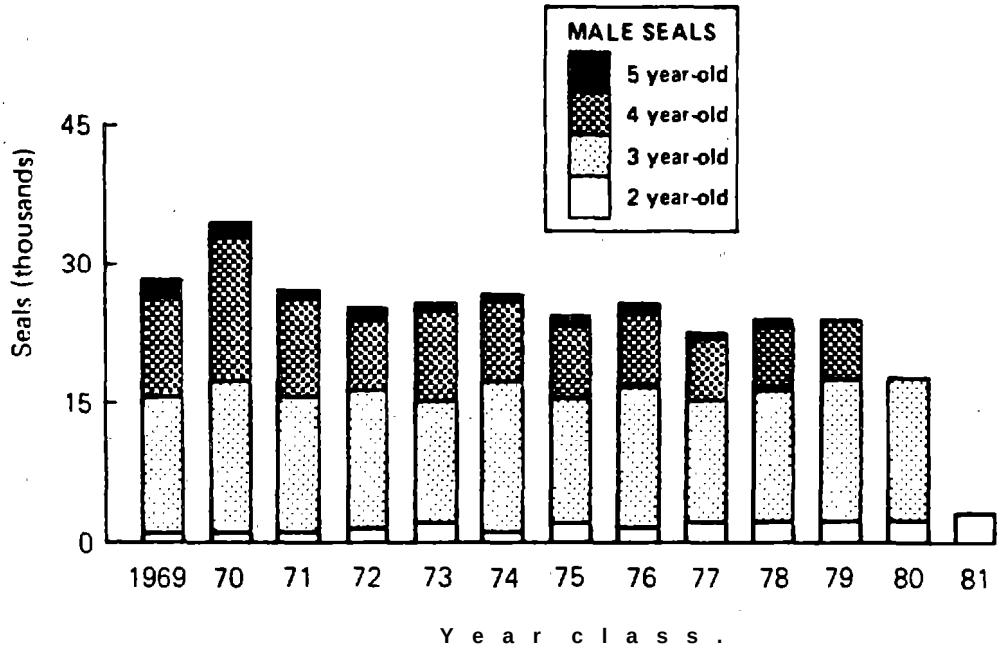

Figure 5. --Size of the male northern fur seal harvest by year class, St. Paul Island, Alaska, 1969-81.

Table 1.--Harvest of male northern fur seals, by age group, St. Paul Island, Alaska, 1969-81 year classes.[a]

Year class	Age group 2	3	4	5	Total harvested
	Number of seals				
1969	323	15,024	10,800	1,631	27,778
1970	916	16,337	15,533	1,402	34,188
1971	577	14,652	10,768	722	26,719
1972	1,025	15,186	8,050	707	24,968
1973	1,642	13,397	9,421	598	25,058
1974	893	16,476	8,955	470	26,794
1975	1,783	13,752	7,918	725	24,178
1976	1,479	15,245	8,183	651	25,558
1977	2,051	13,157	6,714	511	22,433
1978	2,180	14,224	7,016	414	23,834
1979[b]	2,284	15,123	6,644	-	24,051
1980[b]	2,065	15,587	-	-	17,652
1981[b]	3,047	-	-	-	3,047
Total	20,265	178,160	100,002	7,831	306,258
Mean	1,559	14,847	9,091	783	26,151[c]

a Includes only 2- to 5-year-olds taken during the harvest of male seals.

b Incomplete returns.

c 1979, 1980, and 1981 year classes not included.

Table 2.--Age classification of male northern fur seals harvested, St. Paul Island, Alaska, 1974-83.

Year of harvest	Age group 1	2	3	4	5	6	Total harvested
	----------Number of seals----------						
1974	0	1,025	14,652	15,533	1,631	135	32,976
1975	0	1,642	15,186	10,768	1,402	95	29,093
1976	0	893	13,397	8,050	722	19	23,081
1977	0	1,783	16,476	9,421	707	9	28,396
1978	0	1,479	13,752	8,955	598	45	24,829
1979	0	2,051	15,245	7,918	470	18	25,702
1980	0	2,180	13,157	8,183	725	33	24,278
1981	0	2,284	14,224	6,714	651	19	23,892
1982	0	2,065	15,123	7,016	511	15	24,730
1983	16	3,047	15,587	6,644	414	20	25,728

Table 3.--Age classification of male northern fur seals taken in the subsistence harvest on the east hauling ground of North Rookery, St. George Island, Alaska, 21 June to 26 August 1983. A dash indicates no data.

Date	Males harvested	Percent in each age group of sample				Estimated number harvested by age group			
		2	3	4	5	2	3	4	5
June 21	25	-	-	-	-	-	-	-	-
28	23	-	-	-	-	-	-	-	-
July 1	27	3.7	55.6	40.7	0.0	1	15	11	0
5	25	-	-	-	-	-	-	-	-
8	25	0.0	52.3	47.7	0.0	0	13	12	0
12	25	4.0	38.0	58.0	0.0	1	10	14	0
15	25	-	-	-	-	-	-	-	-
19	25	17.8	68.9	13.3	0.0	5	17	3	0
22	24	0.0	50.0	41.7	8.3	0	12	10	2
26	26	64.7	35.3	0.0	0.0	17	9	0	0
29	25	4.0	72.0	24.0	0.0	1	18	6	0
Aug. 2	26	36.4	63.6	0.0	0.0	9	17	0	0
5	49	-	-	-	-	-	-	-	-
12	50	90.0	10.0	0.0	0.0	45	5	0	0
16	51	83.7	16.3	0.0	0.0	43	8	0	0
23	35	-	-	-	-	-	-	-	-
26	14	-	-	-	-	-	-	-	-
Total	500								

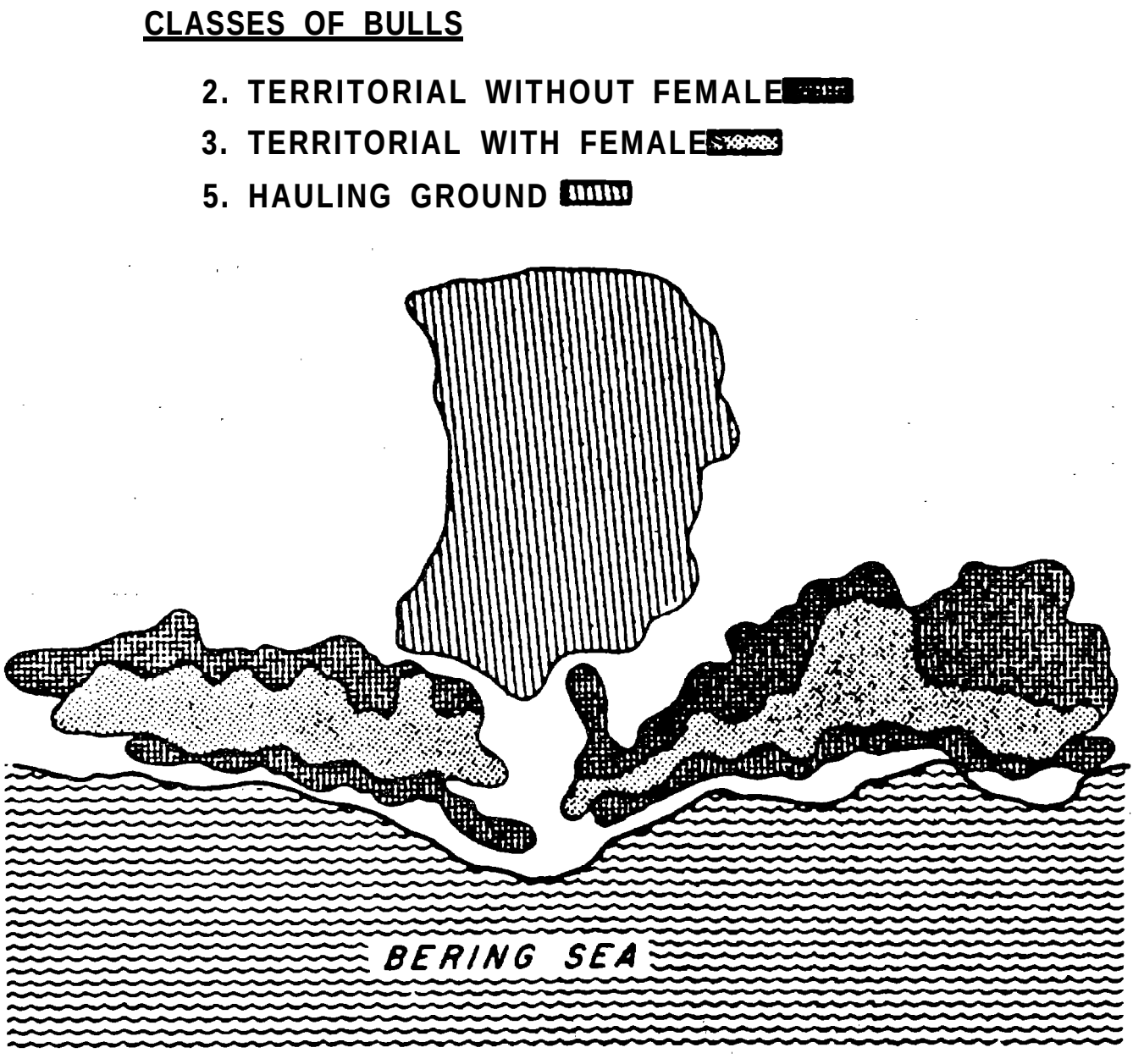

Figure 6. --General composition of a typical fur seal rookery.

Dead Seals Older Than Pups Counted

The rookeries and adjacent beaches of St. Paul Island were surveyed for dead seals older than pups from 31 August to 7 September and totaled 66 females and 57 males. Canine teeth of the animals were collected wherever possible for studies of age at death. Table 4 lists the number of these seals found dead on the Pribilof Islands since 1965.

Dead Pups Counted

In 1983, 5,997 dead fur seal pups were counted on all rookeries of St. Paul Island from 22 to 30 August; counts on St. George Island on 16 August totaled 903 (Appendix Table A-6). The number of dead pups counted on St. Paul and St. George Islands since 1974 is given in Appendix Table A-7.

Table 4.--Number of dead northern fur seals counted that were older than pups, Pribilof Islands, Alaska, 1965-83. A dash indicates no data.

Year	St. Paul Island		St. George Island		Total	
	Males	Females	Males	Females	Males	Females
1965	158	-	-	-	158	-
1966	181	172	41	55	222	227
1967	108	157	41	28	149	185
1968	98	141	33	22	131	163
1969	94	141	22	29	116	170
1970	52	124	4	53	56	177
1971	39	91	5	37	44	128
1972	46	111	22	30	68	141
1973	61	65	7	30	68	95
1974	33	30	4	15	37	45
1975	92	99	-	-	92	99
1976	46	64	-	-	46	64
1977	60	69	-	-	60	69
1978	57	87	-	-	57	87
1979	56	66	-[a]	-[a]	56	66
1980	102	117	14	65	116	182
1981	44	83	12	61	56	144
1982	47	117	-	-	47	117
1983	57	66	-	-	57	66

a A total of 70 dead fur seals of both sexes that were older than pups were counted on the rookeries of St. George Island.

Number of Pups Born in 1983

St. Paul Island--**The total number of pups alive at the time of shearing and its standard error have been estimated, using subsamples of rookeries, since 1980. From the mean estimate from both sampling periods (Table 5) and the mid-July count of harem males (Appendix Table A-4), we compute the ratio of live pups to bulls on the sample rookeries. Following the procedure in the 1980 report of Fur Seal Investigations (Kozloff 1981) we compute the estimate of the ratio of live pups to breeding males for the sample rookeries and estimate total numbers of pups born by multiplying the estimated ratio by total numbers of breeding males on all rookeries and adding the count of dead pups as follows:**

Rookery	Number of pups	Number of breeding males	Ratio pups/bulls	$\bar{r}$	r*
Zapadni Reef	4,800	190	25.26	33.77	29.74
Lukanin	4,182	124	33.73	32.69	33.01
Reef	17,840	529	33.72	32.29	34.18
Vostochni	25,702	760	33.82	31.82	35.61
Total	52,524	1,603	32.77		

where r is the ratio of pups to bulls on all but the particular sample rookery, and

$$r^* \quad 4r - 3\bar{r} \text{ where } r = \frac{\text{total pups}}{\text{breeding males}} = \frac{52,524}{1,603} = 32.77.$$

The estimate of the ratio of pups to bulls is

$$\hat{R} = 1/4 \sum_{j=1}^{4} r^*(j) = 33.135,$$

$$\text{and } \hat{Var}(\hat{R}) = \Sigma \frac{r^*(j)^2 - 4\hat{R}^2}{12} = 1.563 \text{ and } SE(\hat{R}) = 1.250.$$

Table 5.--Estimated number of northern fur seal pups in 1983 at times of shearing and birth on four rookeries of St. Paul Island, Alaska. Pups were sheared 6-9 August; sampling periods 1 and 2 were 19 and 22 August, respectively.

Item	Rookery				
	Zapadni Reef	Lukanin	Reef	Vostochni	Total
No. pups sheared	910	610	2,460	3,709	7,689
No. 25-pup samples					
Period 1	40	21	77	161	-
Period 2	50	26	87	168	-
No. sheared pups counted					
Period 1	254	79	269	569	-
Period 2	201	92	296	619	-
Total no. pups counted[a]					
Period 1	1,100	525	1,925	4,025	-
Period 2	1,250	650	2,175	4,200	-
Estimated no. pups alive[b]					
Period 1 sampling	3,941	4,054	17,604	26,237	51,836
Period 2 sampling	5,659	4,310	18,076	25,166	53,211
Mean, both periods	4,800	4,182	17,840	25,702	52,524
No. dead pups counted	258	171	649	747	1,825
Estimated no. pups born[c]	5,058	4,353	18,489	26,449	54,349

a Number of samples X 25 = total number of sheared and unsheared pups.

b Estimated from $\hat{N} = MC/R$ (M = no. pups sheared, C = total no. pups counted, and R = no. sheared pups counted).

c Sum of dead pups counted and mean estimate of pups alive at times of sampling.

Thus, an approximate 95% confidence interval for the ratio of live pups to harem males is

$$33.135 \pm (3.185)\ (1.250)$$

$$33.135 \pm 3.981.$$

The total number of harem males counted on all rookeries of St. Paul Island is 4,827 (Appendix Table A-4).

Thus, the total numbers of pups at shearing = 159,944 ± 19,216 (with 95% confidence interval);

counted number of dead pups = 5,997; and

total number of pups born = 165,941 ± 19,216

(with an approximate 95% confidence interval).

St. George Island--The number of pups born in 1983 is given in Table 6 and is based on shearing-sampling procedures developed in the 1960's.

Mark Recoveries

During the commercial harvest of male northern fur seals on St. Paul Island, 17 males marked as pups by the Soviet Union were recovered. Appendix Table A-8 lists the number of Soviet tags recovered by the United States in 1983.

Seals Entangled in Net Fragments and Other Materials

The number of entangled northern fur seals appearing in the harvest on St. Paul Island since 1967 is given in Appendix Table A-9.

Table 6.--Estimated number of northern fur seal pups in 1983 at times of shearing and birth on St. George Island, Alaska. Pups were sheared 11-14 August and sampled for marked to unmarked ratios 16 August.

Item	Rookery						
	South	Zapadni	East Cliffs	East Reef	Staraya Artil	North	Total
No. pups sheared	1,064	649	537	256	546	1,970	5,022
No. 25-pup samples	39	41	35	13	23	66	-
No. sheared pups counted	206	168	131	35	99	262	-
Total no. pups counted[a]	975	1,025	875	325	575	1,650	-
Estimated no. pups alive[b]	5,036	3,960	3,587	2,377	3,171	12,406	30,537
No. dead pups counted	111	124	128	25	148	367	903
Estimated no. pups born[c]	5,147	4,084	3,715	2,402	3,319	12,773	31,440

a Number of samples X 25 = total number of sheared and unsheared pups.

b Estimated from N = MC/R (M = no. pups sheared, C= total no. pups counted, and R = no. sheared pups counted).

c Sum of dead counted and estimate of DUDS alive at times of sampling.

Calculation of the Size of the Pribilof Island Fur Seal Stock

During the annual spring meeting of the North Pacific Fur Seal Commission, the United States usually provides an estimate of the size of the Pribilof Island fur seal stock at the time of the completion of the commercial harvest on St. Paul Island in early August of the previous year. It is an estimate that should only be considered as an approximate guide to the number of fur seals in the population at that time. The following is a description of the methods used to determine these calculations. An example of the method is provided in Table 7 for the calculation of the size of the stock in August of 1983.

The estimate for a given year is based on an estimate of the average number of pups born on the Pribilof Islands during that year and the previous 2 years. For example, for 1983, this number (185,300) is the average of the estimate of the numbers of pups born in 1983 (165,800), in 1982 (210,800),and 1981 (179,400). The number of yearlings. is estimated as half the number of pups born, since mortality during the first year is about 50%. Similarly, the number of 2-year-old seals is estimated as 70% of the number of yearlings, since mortality during the second year is about 30%. Juvenile mortality is known to vary greatly from one cohort to another; the mortality rates used here are long-term averages and must be considered crude approximations.

The number of 3-year-old females is estimated as 90% of the 2-year-old females (approximately half of the Z-year-old seals), since mortality for females during the third year is about 10%. The number of females older than 3 years is estimated by dividing the number of pups born by 0.6, the estimated average annual pregnancy rate for females age 4 years and older.

Table 7.--Calculation of the size of the Pribilof Island fur seal stock for 1983.

Component	Seals (thousands)	Explanation
Newborn pups	217.9	(Average of both islands 1981-83)
Yearlings	109.0	(217.9)(0.5) = 109.0; 0.5 = average survival, age 0-1 year.
Age 2 years	76.3	(109.0)(0.7) = 76.3; 0.7 = average survival, age 1-2 years.
Age 3 years		
Females	34.3	(76.3)(0.9)/2= 34.3; 0.9 = average survival, age 2-3 years.
Males after harvest	19.5	(76.3)(0.85)(1-0.4)/2= 19.5; 0.85 = average survival, age 2-3 years; 0.4 for 1973 to the present; before 1973, exploitation rate of males, age 3 years was about 0.5.
Adults		
Females $\geq$ 4 years	363.2	(217.9/(0.6)= 363.2; 0.6 = weighted pregnancy rate.
Males $\geq$ 4 years	50.7	(19.5)(2.6) = 50.7; 2.6 ratio of males $\geq$ 4 years to males after harvest at age 3 years, based on lifetable in Lander, 1981.
Total stock	870.9	

The number of 3-year-old males alive before the harvest in a given year is estimated as 85% of the number of 2-year-old males, since natural mortality for males during the third year is about 15%. The number of 3-year-old males alive after the harvest is about 60% of the number alive at the beginning of the harvest, since the exploitation rate of 3-year-old males is about 40%. (This is under the present harvesting regime with no commercial harvest on St. George Island. Before 1972, when there was a commercial harvest on St. George Island, the exploitation rate was about 50%.) The number of males age 4 years and older is estimated as 2.6 times the number of 3-year-old males. This ratio of the number of males age 4 years and older to the number of 3-year-old males is derived from the fur seal lifetable in Lander (1981).

BEHAVIOR AND BIOLOGY, PRIBILOF ISLANDS, ALASKA

by

Roger L. Gentry and Michael E. Goebel

Work Plan

The research effort on behavior of northern fur seals, Callorhinus ursinus, during 1983 comprised 2,220 worker hours (observations in blinds = 1,282; tag searches = 448; pup marking = 120; female aggression study = 370). The principle effort was to collect data comparable to the 1974-76 baseline description of the herd because of the continuing decline in the number of pups born and in the area occupied by northern fur seals on Pribilof Island rookeries. Comparative measures were made at Zapadni and East Reef Rookeries on St. George Island, and at Kitovi Rookery on St. Paul Island. These measures included activity levels, female attendances, adult male tenure, copulation frequencies, kleptogyny[2] (female stealing), forays of unattached males through a rookery, male/female encounters, and adult male territorial defense. Longitudinal records were also maintained on known males and females.

In addition to the comparative data, several separate projects were undertaken: 1) at Zapadni Rookery, 45 live territorial males were weighed to permit statistical correlations between weight, tenure, and copulation frequency; 2) at Staraya Artil Rookery, 100 newborn seals were marked and their front flippers photographed for G. A. Nesterov of the U.S.S.R.; 3) the return rate and attendance behavior of 3-year-old males were studied on the hauling grounds of St. George Island (see below); 4) 10 females (6 in July, 4 in October) were instrumented with time-depth recorders to

[2] See glossary.

determine whether they use the same diving pattern within and between seasons; 5) the relationship between female gregariousness and female aggression, and the effect of males on this relationship, were studied among 15 captive females at the St. George Island holding facility; 6) 1,100 seals were tagged for future behavioral studies (Table 8); and 7) all hauling grounds on St. George Island were censused once a week (see below).

The recent decline in the number of pups born on the Pribilof Islands has been well documented (North Pacific Fur Seal Commission 1982). A similar decline is apparent in the numbers of both harem and idle males, and the harvests of juvenile males have generally decreased. Has the abundance of juvenile males decreased, and if so has juvenile survival rate decreased? The answers to these questions have important implications for the issue of seal entanglement in fishing debris, which is purported to be a major cause of the recent decline.

Abundance of Juvenile Males

Censuses were made on all hauling grounds of St. George Island once each week from the first week in June to the first week in August from 1978 through 1983. The counts were ended in August because of the influx then of females, which are indistinguishable at a distance from juvenile males, onto the hauling grounds.- All counts were made between 1300 and 1700 hours to coincide with the peak number of seals on shore (Gentry 1981). Only males lacking obvious secondary sexual characteristics were counted. The counts were made from the periphery of hauling grounds using binoculars and tally-counters; averages of multiple counts were reported for high density sites. Counts were usually made on Sundays

Table 8.--Tags applied to northern fur seals for studies of behavior, St. George Island, Alaska, 1983.

Type and color of tag	Tag number	Age-sex class	Number of seals tagged	Rookery
Monel	X751-X775 XA730-XA750	Adult male[a]	45	Zapadni
Plastic Riese, yellow	5130-5174			
Plastic Riese, yellow	5126-5129 5176-5225	Male pup	54	Staraya Artil
	5241-5452	Male pup	212	East Reef
	5453-5688	Male pup	236	Zapadni
Plastic Riese, white	2001-2015 2021-2030 2032-2043 2045-2063	Female pup	56	Staraya Artil
	2064-2066 2068-2074 2076, 2085 2086	Adult female[b]	12	East Reef
	2080-2084	Adult female	5	Staraya Artil
	2067, 2078 2079 2091-2301	Female pup	213	East Reef
	2302-2563	Female pup	262	Zapadni
Plastic Riese, green	2001, 2003 2007	Male pup	3	East Reef
	2002	Female pup	1	East Reef
	2004	Adult female[c]	1	East Reef

a Each male was double-tagged with a monel and yellow Riese tag. El even males bearing the following tags were retagged: green Roto-59 and 73; monel-X1802, X1830, X1838, X1879, X1883, X1886, X1892, X457, and IWO630.

b Four females already bearing a tag were retagged in the following combinations: (white Roto-553, white Riese-2070), (white Roto-543, white Riese-2073), (white Roto-1789, white Riese-2076) and (white Roto-1208, white Riese-2085 and 2086).

c Retag of white Roto-537.

to avoid the disturbances caused by the Friday subsistence harvests; in addition, counts were not made on days of pelting rain which causes the animals to abandon land. Animals taken in subsistence harvests were not included in census totals, and did not affect the trends since consistent numbers were taken (350) each year since 1978 except for 1983 when 500 were taken.

Figure 7 shows a general decline in the number of juvenile males counted on hauling grounds from 1978 to 1983. An Analysis of Variance (ANOVA) of the entire data array showed no significant differences among years ($p = 0.76$). However, this result mainly reflected the similarity of censuses in June before the population peaked. Considering only the July counts, when numbers are stable, censuses in the last 3 years (1981-83 inclusive) were significantly lower (ANOVA, $p = 0.99$) than in the three preceding years. A major decline apparently occurred between 1980 and 1981; the differences within each group (before and after the decline) were not significant. The total decrease was approximately 24.0% (difference between 1978 and 1983). This decline did not reflect the increased number of seals taken in the 1983 subsistence harvest as these were taken after censuses ceased.

This decline was also apparent upon examining the extent of area occupied at each hauling ground. A wild celery, Heracleum lanatum (locally known as "Poochki"), does not grow on actively used seal rest sites. The sites presently used by juvenile males are much smaller, as evidenced by the surrounding area in which H. lanatum had been trampled by former generations of juvenile males. Furthermore, from 1978 to 1980 the Zapadni and East Reef hauling grounds were large, continuous populations, but now they are a series of discrete subgroups.

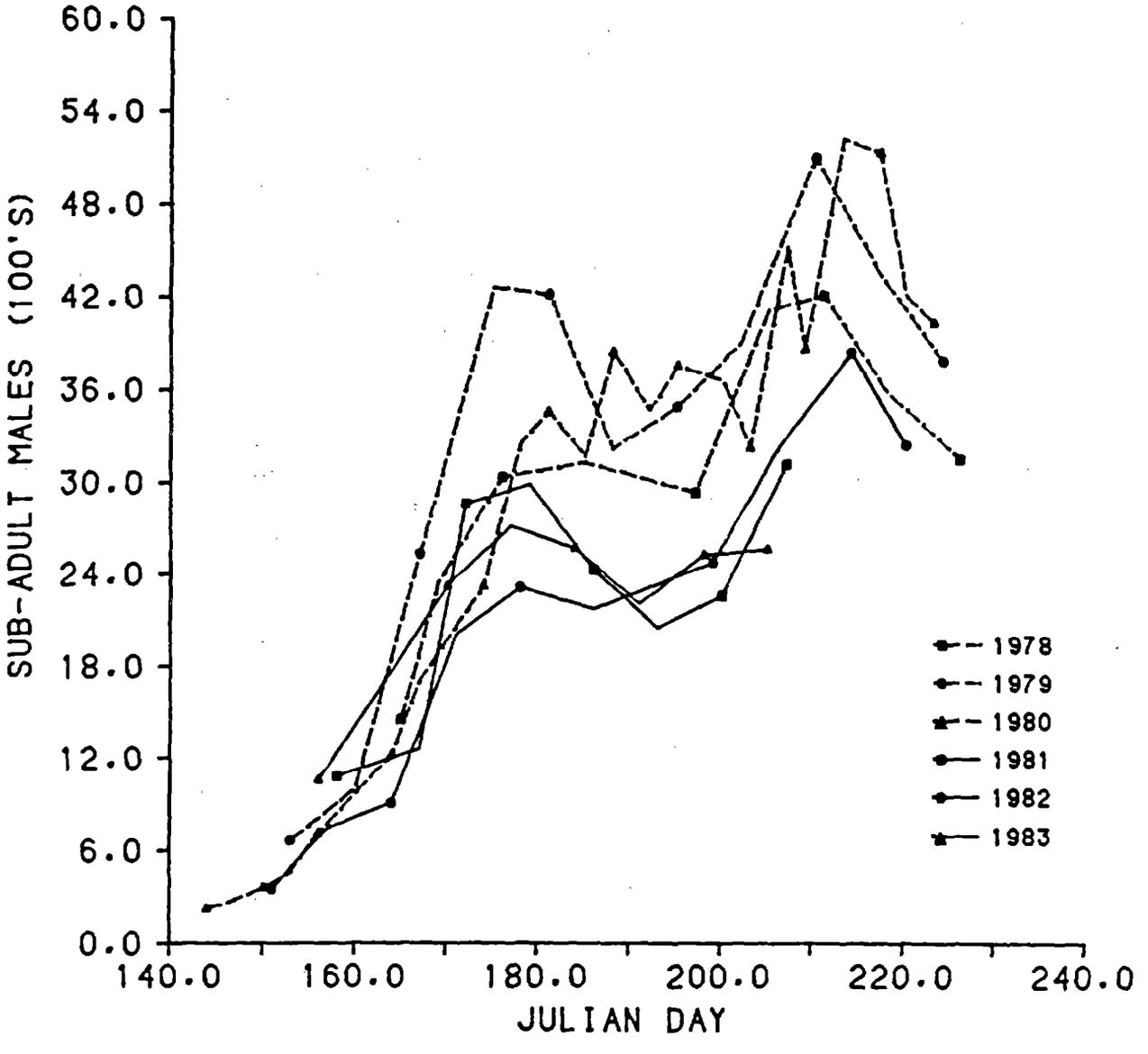

Figure 7. --Trends in the number of juvenile males counted on the hauling grounds of St. George Island, Alaska, 1978-83.

Index of Juvenile Male Survival

Has the survival rate of juvenile males changed sufficiently to explain these decreased numbers ashore? Survival from birth to age 2 years was estimated by Lander (1979) and the interannual survival of seals that return each year (=75.0%) was measured by Gentry (1981). Survival from birth to age at return is difficult to measure accurately because the tagged animals needed for the assessment may 1) disperse to other islands, 2) lose their tags, 3) survive but fail to return to the island until an advanced age, or 4) die as a result of tagging. The proportion that returns to land at a given age can be used as an index of survival assuming that the proportion of survivors that returns by that age does not change. Lander (1979) also made this assumption in taking the harvest of 3-year-olds as an index of survival. We define this 'recovery rate' index as the proportion of tags recovered, either by sighting or by harvesting, at age 3 years.

The recovery rate of tagged seals was measured and compared to recoveries from past harvests. Male pups were tagged at East Reef, Staraya Artil, and Zapadni Rookeries in 1980 using yellow, numbered plastic tags. Every day from 20 June to 14 August 1983 two observers using binoculars and telescopes surveyed all hauling grounds except the east hauling ground of North Rookery (Northeast hauling ground) for tagged males. Northeast hauling ground was surveyed once a week during the Sunday census. All observations were made between 1300 and 1700 hours. The return rate was taken as the number of tags observed on St. George Island in 1983 divided by the number tagged in 1980.

To estimate the rate of tag loss, three drives were conducted, one on each of the three hauling grounds. As many of the available seals as possible were herded together, and pods of 10 seals were separated out for visual examination of tag scars on the front flippers.

Recovery rate from harvest data was assessed by calculating the proportion of a tagged cohort that was later harvested. Only St. Paul Island harvest data were used; St. Paul Island seals harvested elsewhere were not included. To estimate recovery rate at age 3 years, the number of tagged 2- and 3-year-olds taken from each age class from 1955 through 1965 was summed and divided by the number of pups tagged in that age class. These year classes were used for comparison because this period preceded reported entanglement of juvenile males (Fowler 1982). The tables from which these calculations were made were also used to estimate tag loss.

In our study, the recovery rate was 6.8% (155/2,289 tagged), and the tag loss rate (single tag) was 26.0%. Another 67 tags were observed at St. Paul Island, 76.0% of which were not seen at St. George Island. In the 1955-65 year classes, the mean recovery rate at age 3 years was 7.6% (15,448/202,599 tagged), and the tag loss rate averaged 27.0% (range 11.0%-36.0%). Tags observed at other islands were not calculated. The latter recovery rate included the 1956 year class in which survival was low due to hookworm infestation (Lander 1979). If this year class is excluded, the variance around the mean recovery rate decreases, but still includes the 6.8% value calculated by our study. This suggests that the present recovery rate at age 3 years is comparable to the rate from a lo-year period of fur seal history before entanglement became common enough to report.

The two estimates of recovery rate were derived by different methods, but neither was necessarily more accurate than the other; tagged seals were probably missed in both studies. During the harvests

on St. Paul Island, all tags that were present were collected, but the harvests occurred only once at each site every 5 days, usually in the early morning when peak numbers were not present. Our observations on St. George Island undoubtedly missed some seals each day, but the observations occurred every day during peak numbers, and lasted longer than the harvest season.

The comparison included further complications. For example, some tags reported in the St. Paul Island data were applied at other islands, which would tend to decrease the recovery rate. However, the St. Paul Island seals that were harvested at other islands (that could have returned to be recovered) were not included. These two values would tend to offset each other's effect on recovery rate. Finally, tag types and numbers applied to each seal differed, and thus tag-induced mortality may have differed. It is doubtful that any of the exceptions would change the estimated recovery rate such that our value would not fall within 1 SD of the mean.

Our results show that the number of juvenile males on land has declined over the past 6 years, and that the area occupied by these animals has also declined. However, the recovery rate at age 3 years, according to the study method used, has not changed. If recovery rate is a valid index of survival, then the results imply that the present decline in the male population has not resulted from decreased survival but rather from a decrease in the number of males born.

The suggestion that juvenile male survival rate has not changed relative to the period 1955-68, i.e., before entanglement became prevalent, has important implications. Either the effect of entanglemnt is less than the 2.0X-4.0% estimated (Fowler 1983) or its effect on mortality is

too small to measure by this method. Because of this implication, it is important that our result be validated. The recovery rate of seals taken in the harvest should be repeated using the same methods as previously. The observational method should also be repeated to calculate recovery rate of additional cohorts and to compare interannual survival against the 75.0% value calculated for 1978-80.

POPULATION AND BEHAVIORAL STUDIES, SAN MIGUEL ISLAND, CALIFORNIA

(ADAMS COVE AND CASTLE ROCK)

by

George A. Antonelis, Jr., and Robert L. DeLong

Adams Cove

During the 1983 field season, research activities on northern fur seals, Callorhinus ursinus, included population monitoring, a pup tagging program, and a female nursing cycle study.

Population Information

The most important population information for the Adams Cove colony is summarized in Table 9. The 1983 field season commenced on 10 June, at which time there were 5 large adult males (8-12 years old), 1 small adult male (5-7 years old), 11 subadult males (bachelors[3]), 4 adult females, and 1 live pup. In 1983, a total of 408 pups were born, representing a 60% decrease from the 1982 count of 1,029.

The total number of territorial males increased from 30 in 1982 to 31 in 1983. Three of these territorial males were known to be 8 years of age (tagged as pups in 1975). A maximum count of 37 bachelors was recorded on 18 July.

The greatest number of adult females on land occurred on 15 July when 377 were counted, representing a decrease of 40% from the maximum count of 628 in 1982.

Tagging Program and Records

The fur seal pup tagging program on San Miguel Island began in 1975, and the subsequent resightings of these tagged animals on the

3 See glossary.

Table 9.--Summary of some observations of the northern fur seal colony in Adams Cove, San Miguel Island, California, 1969-83.

Observation	1969	1970	1971	1972	1973	1974	1975
Season span							
Beginning date[a]	16 May	23 May	15 May	16 May	9 May	20 May	19 May
Ending date	1 Oct.	20 Sept.	6 Sept.	7 Sept.	15 Aug.	9 Sept.	6 Sept.
First male	16 May	29 May	24 May	16 May	26 May	20 May	12 May
First female	27 May	28 May	25 May	22 May	17 May	20 May[b]	19 May
First birth	6 June	28 May	31 May	22 May	7 June[c]	27 May	27 May
Mean birth date	24 June	21 June	26 June	22 June	24 June	23 June	27 June
Total births	28	33	45	70	68	220	329
Total pup deaths	2	14	15	21	17	52	46
Total females (maximum counted and date)[d]	175	179	274	310	394	551	563
	23 Aug.	23 Aug.	2 Sept.	16 Aug.	4 Aug.	8 Sept.	24 Aug.
Total large adult males	4	2	4	6	6	6	10[e]
Total small adult males	4	4	6	7	5	6	6
Total bachelors[f]	4	5	6	10+	6	8	7

Table 9. --Continued.

Observation	1976	1977	1978	1979	1980	1981
Season span						
Beginning date[a]	29 May	18 May	17 May	15 May	17 May	9 June
Ending date	14 Sept.	22 Sept.	9 Sept.	15 Sept.	23 Sept.	13 Sept.
First male	29 May[g]	18 May[h]	17 May[b]	21 May	17 May[j]	9 June[k]
First female	29 May[g]	18 May[h]	17 May[l]	16 May[m]	23 May	9 June[k]
First birth	29 May[i]	29 May	30 May	28 May	24 May	9 June[k]
Mean birth date	29 June	25 June[n]	24 June	29 June	29 June	26 June
Total births	417	421	635	834	896	941
Total pup deaths	91	64	77	72	103	289
Total females (maximum counted and date)[d]	495	681	584	702	665	717
	14 July	26 Aug.	18 Aug.	25 Aug.	31 Aug.	1 July
Total large adult males	7	7	13[f]	11	9	10
Total small adult males	5	3	12[o]	13[o]	10	11
Total bachelors[f]	11	7+	19	50	68	95

Table 9. --Continued.

Observation	1982	1983
Season span		
Beginning date[a]	9 June	10 June
Ending date	6 Dec.	20 Aug.
First male	9 June[p]	10 June[r]
First female	9 June[p]	10 June[r]
First birth	9 June[p]	10 June
Mean birth date	25 June[n]	1 July
Total births	1,029	408
Total pup deaths	51	89
Total females (maximum counted and date)[d]	628 8 July	377 15 July
Total large adult males	30	31
Total small adult males	22[q]	30[q]
Total bachelors[f]	88	37

[a] Beginning and ending dates of continuous observations.
[b] May have arrived earlier.
[c] One still birth occurred on 19 May.
[d] A few 2-, 3-, and 4-year-old males may have been included because they are about the same size as adult females.
[e] Includes 2 males who arrived in late August and were not territorial (probably from Castle Rock).
[f] Subadult males about 104-127 cm in body length, tip of nose to tip of tail.
[g] Four large adult males, 9 females present 29 May--arrived prior to 29 May.
[h] Three large adult males and 2 females present 18 May--arrived prior to 18 May.
[i] One pup present 29 May--born prior to 29 May.
[j] Two large adult males present 17 May--arrived prior to 17 May.
[k] Seven large adult males, 86 females, and 24 pups present 9 June--arrived prior to 9 June.
[l] Two females present 17 May--arrived prior to 17 May.
[m] Four females present 16 May--arrived prior to 16 May.
[n] Estimated from previous breeding season information.
[o] Includes 6 small adult males who were not territorial.
[p] Seven adult males, 28 subadult males, 20 females, and 5 pups present.
[q] None of these males were territorial.
[r] Five large adult males, 1 small adult male, 11 subadult males, 4 females, and 1 pup present 10 June--arrived prior to 10 June.

island are shown in Appendix Table A-10. Tag resightings have also been obtained when dead or emaciated pups of the year are found on beaches or adrift at sea. Most of these tag recoveries have been recorded north of Point Conception along the coasts of California, Oregon, and Washington. The northernmost record of a pup stranding occurred in the Queen Charlotte Islands, at Shingle Bay, Sandspit, British Columbia.

In order to compare tag longevity (durability and retention) and long-distance identification,, two different types of tags were used to mark fur seal pups at Adams Cove. On 26 September, 100 fur seal pups were double-tagged with pink Roto-tags (hard plastic) and modified (round posts) monel cattle ear tags. The Roto-tags were modified to include a hole-punch coding system which would provide additional tag identification in the event that the embossed alpha-numeric codes became illegible (Fig. 8). All tagged pups were checkmarked by removing the cartilaginous extension of the fifth digit on the right hind flipper (Appendix Table A-11).

Records have been kept of tagged seals observed ashore in Adams Cove since 1968. In recent years, reading tag numbers has become increasingly difficult due to a redistribution of fur seals into areas which are in excess of 200 m from observational sites. The redistribution has resulted in a relatively small number of monel tag returns for 1982-83, and a proportionally higher frequency of plastic Roto-tag returns which had numbers that were more easily read (Appendix Tables A-12 and A-13).

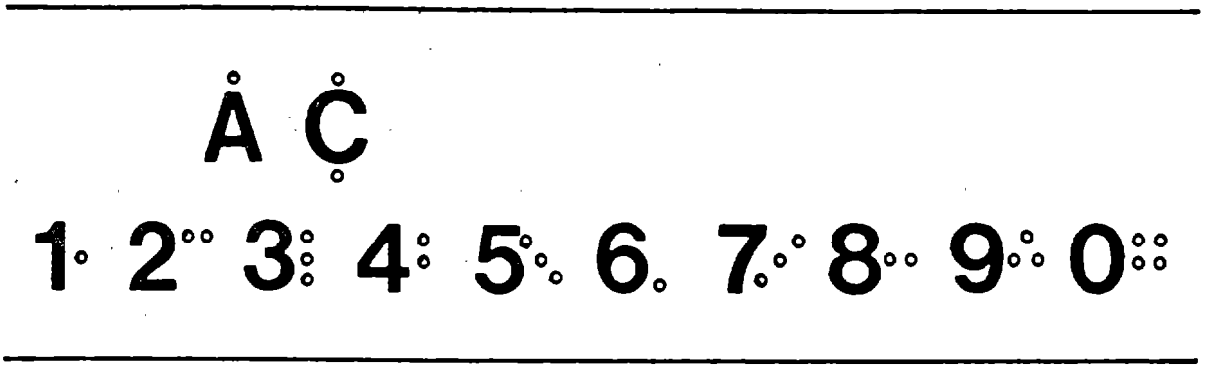

Figure 8.--Alpha-numeric hole-punch coding for Roto and Riese-tags used on pinnipeds at San Miguel Island, California. (Coding system originally designed by Harriet Huber, Point Reyes Observatory, 4990 Shoreline Highway, Stinson Beach, CA 94970.)

In 1983, there were no sightings of marked fur seals from other rookeries, but records of tag resightings were kept for adult females and juvenile males that had been tagged on San Miguel Island (Appendix Tables A-12 and A-13).

Mortality on Land

The mortality of the fur seal pups born in Adams Cove increased from 5% (51) in 1982 to 22% (89) in 1983. The primary reason for the difference in mortality rates between the 2 years was the relatively large number of pups that died during periods of abnormally hot weather conditions in 1983 (i.e., high air and sand temperature, solar radiation, and low wind speed combine to raise a fur seal's body temperature and cause heat prostration). On 4, 10, and 11 July 1983, 47% (42) of the total pup deaths resulted from heat prostration. The cause of death for the other 47 pups in 1983 was undetermined.

Female Nursing Cycles

In 1983, a study of female nursing cycles was conducted in order to con-pare how females partitioned their time on land and at sea with similar data collected in 1982. In 1983, the mean number of days. females remained on land after parturition was 6.4 days (n=27). This value was not significantly different from the 6.5-day average obtained in 1982 (n=22). Similarly, there was no significant difference between the mean number of days females remained on land after their first and second feeding trips to sea for 1982 (1.84) and 1983 (1.86). However, females spent a significantly greater amount of time at sea during their first three feeding sojourns in 1983 than they did in 1982 ($p<0.01$, Mann-Whitney two sample test). The average number of days females foraged at sea during these periods was 7.5 in 1983 and 5.6 in

1982. One possible explanation for these differences may have been due to the unusually warm water conditions (El Nino) that occurred in 1983 which caused a decrease in the availability of the prey to fur seals, thereby resulting in their need to forage for longer periods in order to maintain their nutritional requirements.

Castle Rock

A summary of census information for Castle Rock is presented in Table 10 for 1972-83. In 1983, a count of 245 pups (227 live and 18 dead) was obtained on 3 August, representing a decrease in pup production of 435 animals (64%) from 1982.

On 1 July, 20 breeding males were counted on Castle Rock from aerial photographs, representing a decrease of 7 breeding males from the 1982 count.

On 25 September, 97 fur seal pups were tagged on Castle Rock. Sixty-eight pups were double-tagged with monel cattle ear tags and pink Roto-tags. Monel tags were attached to the right foreflippers of males and the left foreflippers of females. Modified pink Roto-tags (Fig. 8) were attached to the right 'foreflippers of females and the left foreflippers of males. Twenty-nine pups were double-tagged by attaching a monel tag to each foreflipper. All seals were checkmarked by removing the cartilaginous extension on the fifth digit of the right hind flipper (Appendix Table A-14).

Table 10.--**Summary of censuses of northern fur seals, Castle Rock, California,** 1972-83.

Fur seals	Numbers observed, methods and date of observation					
	1972	1973	1974	1975	1976	1977
Females	223[a] 1 Aug.	345[a] 11 July	301(+)[d] 2 Aug.	396(+)[d] 2 Aug.	526[c] 27 June	617(+)[d] 29 July
Pups (total observed)[e]	95[a] 1 Aug.	193[b] 28 July	301(+)[b] 2 Aug.	396[b] 2 Aug.	521[b] 25 July	617[b] 29 July
Pups (dead observed)	- -	33[b] 28 July	21[b] 2 Aug.	28[b] 2 Aug.	27[b] 25 July	20[b] 29 July
Reproductive large adult males[f]	9[a] 1 Aug.	13[a] 11 July	11[a] 2 July	15[a] 1 July	16[c] 27 June	9(+)[a] 26 July
Total large adult males	10[a] 1 Aug.	14[a] 11 July	20[a] 2 July	20[a] 1 July	18[c] 27 June	9(+)[a] 26 July
Total small adult males	- -	- -	- -	- -	- -	- -

Table 10. --Continued.

Fur seals	Numbers observed, methods and date of observation					
	1978	1979	1980	1981	1982	1983
Females	533(+)[d] 2 Aug.	653(+)[d] 1 Aug.	563(+)[d] 1 Aug.	597(+)[d] 27 July	680(+)[d] 31 July	245(+) 3 Aug.
Pups (total observed)[e]	533[b] 2 Aug.	653[b] 1 Aug.	563[b] 1 Aug.	597[b] 27 July	680[b] 31 July	227 3 Aug.
Pups (dead observed)	26[b] 2 Aug.	27[b] 1 Aug.	38[b] 1 Aug.	29[b] 27 July	34[b] 31 July	18 3 Aug.
Reproductive large adult males[f]	20[a] 1 July	27[a] 3 July	27[a] 1 July	28[a] 2 July	27[a] 2 July	20[a] 1 July
Total large adult males	25[a] 1 July	32[a] 3 July	32[a] 1 July	29[a] 2 July	38[a] 2 July	40[a] 1 July
Total small adult males	- -	7[a] 3 July	2[a] 1 July	12[a] 2 July	7[a] 2 July	13[a] 1 July

a Counts obtained through aerial photographs.
b Land-based counts from afoot.
c Offshore counts from skiff.
d Minimum estimate from pup count.
e Includes dead pup count.
f Territorial adult males with females.

A NEW NORTHERN FUR SEAL ROOKERY, BOGOSLOF ISLAND, ALASKA

by

Thomas R. Loughlin

From 1976 to 1981, small numbers of northern fur seals, Callorhinus ursinus, were sighted on Bogoslof Island, Alaska, a small, volcanic island in the southeastern Bering Sea, about 100 km (60 miles) west of Dutch Harbor (Fig. 9). In October 1982, about 65 fur seals ranging from juveniles to mature adults were observed on the island, but extensive breeding and pupping on the island could not be confirmed. On 11 August 1983, the existence of a fur seal rookery was confirmed on the northwest part of the island by the observation of at least 65 animals older than pups (47 males and 18 females) and 11-13 pups. We tagged 13 males, all 18 females, and 8 pups. Three previously tagged fur seals were observed, 2 adult males and 1 white-whiskered female; the female had been tagged in the U.S.S.R.'s Commander Islands in 1976. On 12 August, we counted fewer fur seals hauled out, but several untagged females were present indicating that the rookery contained more animals than those counted the previous day. It is noteworthy that this rookery has become established at a time when the Pribilof Islands fur seal population has suffered a reduction of about 5% per year for the past several years. The establishment of the Bogoslof rookery is apparently an original colonization since the island was formed by volcanic activity in 1796; the volcanic activity continued almost unabated until the early 1900s.

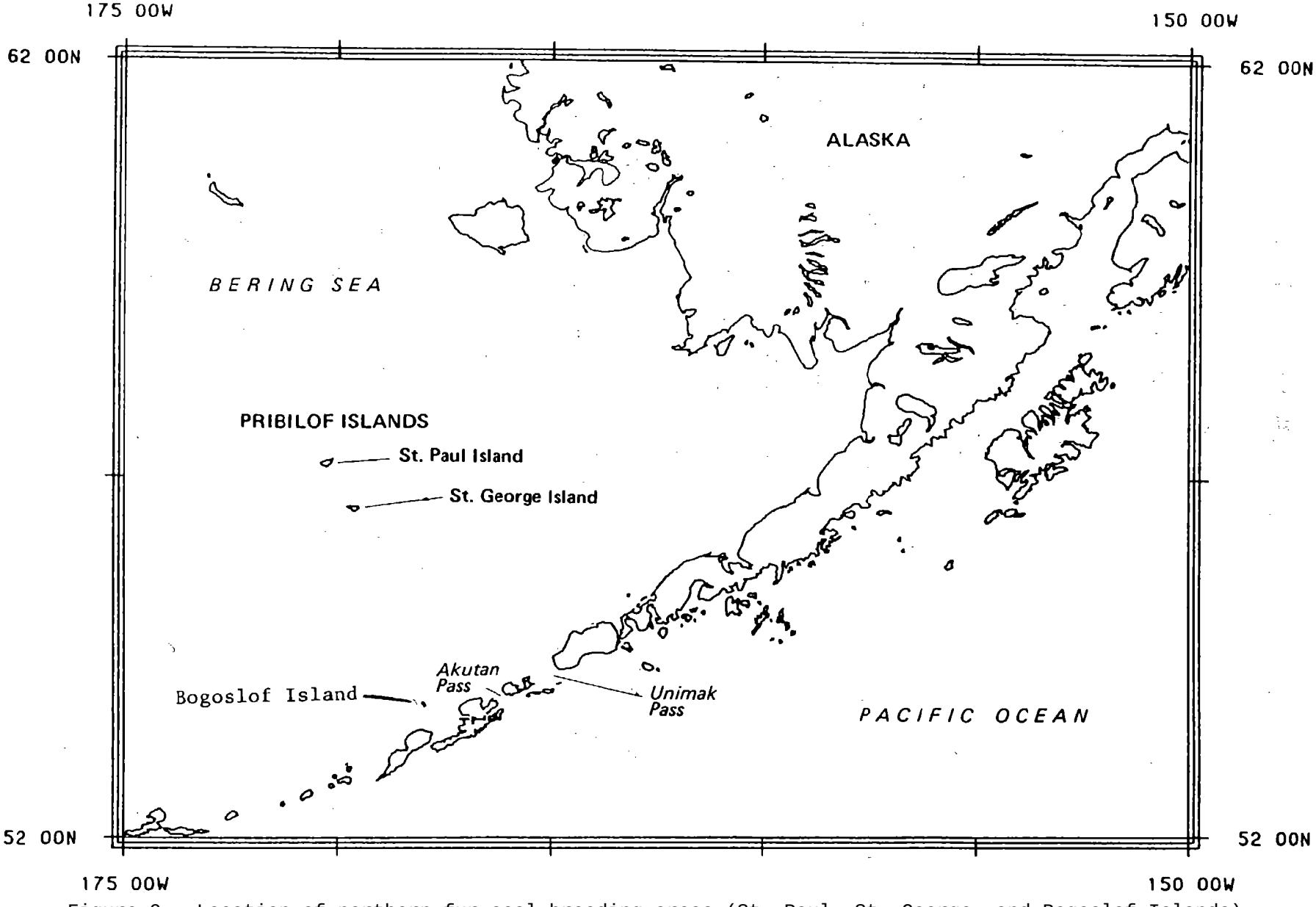

Figure 9.--Location of northern fur seal breeding areas (St. Paul, St. Goerge, and Bogoslof Islands).

ACKNOWLEDGMENTS

Research on the Pribilof Islands, Alaska, in 1983 was completed with the cooperation and assistance of the staff of the Pribilof Islands Program, particularly Joe Scordino, Resource Management Specialist; Vyacheslav Melovidov, Sealer Foreman; Victor Malavansky and John R. Merculief, Representatives in Charge; and Richard M. Frazier, Engineer.

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GLOSSARY

The following terms used in fur sealresearch and management on the Pribilof Islands, San Miguel Island, and Castle Rock have special meanings or are not readily found in standard dictionaries:

Bachelor--Young male seals of ages 2-5 years.

Check Mark--A notch, slit, hole, or other mark made on a seal flipper when a tag is applied, to ensure recognition of an animal that has lost its tag.

Drive--The act of surrounding and forcing groups of seals to move on land from one-location to another.

Escapement--Seals that were not harvested because they were too old, too large, or were not available.

Hauling Ground--An area, usually near a rookery, on which nonbreeding seals congregate. See Rookery.

Haul Out--The act of seals moving from the sea to a rookery or hauling ground on shore.

Kleptogyny--The act of an adult male seal (primarily classes 1, 2 or 3) seizing an adult female from another male's territory.

Known-Age--Refers to a seal whose age is known because the animal bears an inscribed tag or other type of mark.

Male Seals, Adult

Class 1 (Shoreline)--Full-grown males apparently with established territories spaced along the water's edge at intervals of 10-15 m. Most of these animals are wet or partly wet, and some acquire harems of one to four females between 10 and 20 July. They would then be called harem males (Class 3).

Shoreline and Class 1 males should not be confused with

Class 2 animals. The latter definitely have territories, whereas the shoreline males appear to be attached to such sites but may not be in all cases.

Class 2 (Territorial without females)--Full-grown males that have no females, but are actively defending territories. Most of these animals are located on the inland fringe of a rookery, some are between Class 1 (Shoreline) and Class 3 (Territorial with females) males, and an occasional Class 2 male may be completely surrounded by Class 3 males and their harems.

Class 3 (Territorial with females)--Full-grown males actively defending territories and females. Most Class 3 males and their harems combine to form a compact mass of animals. Isolated individuals, usually with small harems, may be observed at each end of a rookery, on sand beaches, and in corridors leading to inland hauling grounds. Some territorial males have as few as one or two females. Should these females be absent during the counts, their pups are used as a basis for putting the adult male into Class 3 rather than Class 2.

Class 4 (Back fringe)--Full- and partly-grown males on the inland fringe of a rookery. A few animals too young and too small to include in the count may be found here. Though some Class 4 males may appear to be holding territories, most will flee when approached or when prodded with a pole.

Class 5 (Hauling ground)--The hauling grounds contain males from May to late July and a mixture of males and females from then on. The counts include males that obviously are adults and all others

that have a mane and the body conformation of an adult. Males included in this count will be approximately 7 years of age and older.

Prior to 1966, Class 3 males were called harem bulls, and Classes 1, 2, 4, and 5 were collectively called idle bulls. From 1966 through 1974, the adult male seals were classified into five groups (Classes 1, 2, 3, 4, and 5). Beginning in 1975, Classes 1 and 2 were combined and designated as Class 2, Class 3 remained the same, and Classes 4 and 5 were combined and designated as Class 5.

Marked--Describes a seal that has been marked by removing the cartilaginous tip of a digit from a hind flipper, by attaching an inscribed metal or plastic tag to one or more of its -flippers, by-freeze marking, by hair-clipping, or by bleaching.

Mark Recoveries--Includes the recoveries of seals marked by one of several methods. See Marked.

Rookery--An area on which breeding seals congregate.

Round--The sequence in which hauling grounds are visited for the drive to harvest seals. A circuit or round of the hauling grounds is completed in 5 days, and the procedure is repeated throughout the harvest of males.

The following are English translations of Russian names given to some of the rookeries or hauling grounds by Russian fur hunters in the late 1700s:

Russian	English
	St. Paul Island
Vostochni	From "Novoctoshni" meaning "place of recent growth"; applied to Northeast Point which was apparently at one time an island that has since been connected to St. Paul Is-land by drifting sand.
Morjovi	Walrus. Historically, walruses hauled out here in summer.
Polovina	Halfway (to Northeast Point from the village).
Kitovi	Of "Kit" or whale. When whaling fleets were active in the Bering Sea between 1849 and 1856, a large right whale killed by some ship's crew drifted ashore here.
	ship's crew drifted ashore here.
Gorbatch	Humpback. Apparently refers to the "hump like" nature of the scoria slope above the rookery.
Tolstoi	Thick. In this case, thick headland on which the rookery is located.
Zapadni	West. Western part of the island.

Lukanin	So named after a Russian pioneer sailor who was said to have taken over 5,000 sea otters from St. Paul Island in 1787.
Zoltoi (hauling ground)	Golden.

St. George Island

Staraya Artil	Old settlement or village. There was once a settlement or village adjacent to the rookery.
Zapadni	West. Western part of the island.

Sea Lion Rock

Sivutch	Sea lion. These animals haul out but do not breed here.

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APPENDIX A

Tabulations of northern fur seal data collected on the Pribilof Islands, Alaska, and on San Miguel Island, California, and nearby Castle Rock in 1983.

APPENDIX A (Continued)

Page

Table A-1 .--Daily age classification of male northern fur seals harvested, St. Paul Island, Alaska, 5 July to 5 August 1983.

Date	Rookery[a]	Males harvested	Tooth sample	Percent in each age group of sample						Estimated number harvested by age group					
				1	2	3	4	5	6	1	2	3	4	5	6
July 5	TZR	384	67	0.0	1.5	56.7	38.8	3.0	0.0	0	6	218	149	11	0
5	ZAP	162	35	0.0	2.8	68 6	28.6	0.0	0.0	0	5	111	46	0	0
6	NEP (e)	580	118	0.0	3.4	55.9	39.8	0.9	0.0	0	20	324	231	5	0
6	NEP (w)	587	117	0.0	4.3	53.0	41.9	0.8	0.0	0	25	311	246	5	0
7	POL	544	104	0.0	6.7	50.0	40.4	1.9	1.0	0	37	272	220	10	5
7	L-K	183	37	0.0	5.4	37.8	54.1	2.7	0.0	0	10	69	99	5	0
8	REEF	1,170	222	0.0	1.8	52.2	44.6	1.4	0.0	0	21	611	522	16	0
11	TZR	1,073	140	0.0	7.9	62.1	27.1	2.9	0.0	0	85	666	291	31	0
12	ZAP	836	166	0.0	1.2	74.7	22.9	1.2	0.0	0	10	625	191	10	0
13	NEP (e)	861	165	0.0	9.1	61.8	26.7	2.4	0.0	0	78	532	230	21	0
13	NEP (w)	457	87	0.0	8.0	64.4	27.6	0.0	0.0	0	37	294	126	0	0
14	POL	591	116	0.0	4.3	57.7	37.1	0.9	0.0	0	26	341	219	5	0
14	L-K	333	67	0.0	3.0	50.7	44.8	1.5	0.0	0	10	169	149	5	0
15	REEF	1,389	252	0.0	7.9	64.7	25.4	2.0	0.0	0	109	899	353	28	0
18	TZR	663	130	0.0	3.8	63.1	32.3	0.0	0.8	0	25	419	214	0	5
19	ZAP	527	100	0.0	12.0	70.0	17.0	0.0	1.0	0	63	369	90	0	5
20	NEP (e)	1,150	224	0.5	8.0	63.4	26.3	1.8	0.0	6	92	729	302	21	0
20	NEP (w)	489	95	0.0	9.5	65.3	24.2	1.0	0.0	0	47	319	118	5	0
21	POL	685	131	0.0	5.3	55.0	36.6	3.1	0.0	0	36	377	251	21	0
21	L-K	697	133	0.0	10.5	68.4	18.8	2.3	0.0	0	73	477	131	16	0
22	REEF	1,566	292	0.0	14.7	59.9	23.0	2.1	0.3	0	230	938	360	33	5
25	TZR	527	103	1.9	7.8	53.4	33.0	3.9	0.0	10	41	281	174	21	0
26	ZAP	971	187	0.0	10.2	68.4	20.3	1.1	0.0	0	99	664	197	11	0
27	NEP (e)	1,396	266	0.0	16.2	66.9	16.5	0.4	0.0	0	226	934	230	6	0
27	NEP (w)	535	107	0.0	17.8	64.5	16.8	0.9	0.0	0	95	345	90	5	0
28	POL	591	117	0.0	11.1	57.3	30.8	0.8	0.0	0	65	339	182	5	0
28	L-K	434	81	0.0	19.7	60.5	17.3	2.5	0.0	0	85	263	75	11	0
29	REEF	1,948	361	0.0	18.7	60.7	18.5	1.1	0.0	0	384	1,183	360	21	0

Table A-1 .--Continued.

Date	Rookery[a]	Males harvested	Tooth sample	Percent in each age group of sample						Estimated number harvested by age group					
				1	2	3	4	5	6	1	2	3	4	5	6
Aug. 1	ZAP	1,067	206	0.0	20.9	63.1	14.6	1.4	0.0	0	223	673	156	15	0
2	TZR	438	85	0.0	12.9	44.7	37.7	4.7	0.0	0	56	196	165	21	0
3	NEP (e)	839	169	0.0	21.3	54.4	21.3	3.0	0.0	0	179	456	179	25	0
3	NEP (w)	391	77	0.0	27.3	59.7	11.7	1.3	0.0	0	107	233	46	5	0
4	POL	274	55	0.0	20.0	56.4	23.6	0.0	0.0	0	55	154	65	0	0
4	L-K	124	23	0.0	40.0	60.0	0.0	0.0	0.0	0	50	74	0	0	0
5	REEF	1,266	244	0.0	26.6	57.0	14.8	1.6	0.0	0	337	722	187	20	0

a NEP (e) = East or Morjovi side of Northeast Point;
NEP (w) = West or Vostochni side of Northeast Point;
TZR = Tolstoi, Zapadni Reef, and Little Zapadni;
POL = Polovina , Polovina Cliffs, and Little Polovina;
ZAP = Zapadni;
REEF = Reef, Gorbatch, and Ardiquen;
L-K = Lukanin and Kitovi.

Table A-2.--Cumulative age classification of male northern fur seals harvested, St. Paul Island, Alaska, 5 July to 5 August 1983.

Date	Rookery[a]	Estimated number harvested by age group						Total harvest to date	Percent harvested by age group					
		1	2	3	4	5	6		1	2	3	4	5	6
July 5	TZR	0	6	218	149	11	0	384	0	1	57	39	3	0
5	ZAP	0	11	329	195	11	0	546	0	2	60	36	2	0
6	NEP (e)	0	31	653	426	16	0	1,126	0	3	58	38	1	0
6	NEP (w)	0	56	964	672	21	0	1,713	0	3	57	39	1	0
7	POL	0	93	1,236	892	31	5	2,257	0	4	55	40	1	0
7	L-K	0	103	1,305	991	36	5	2,440	0	4	54	41	1	0
8	REEF	0	124	1,916	1,513	52	5	3,610	0	3	53	42	2	0
11	TZR	0	209	2,582	1,804	83	5	4,683	0	4	55	39	2	0
12	ZAP	0	219	3,207	1,995	93	5	5,519	0	4	39	34	2	0
13	NEP (e)	0	297	3,739	2,225	114	5	6,380	0	5	58	35	2	0
13	NEP (w)	0	334	4,033	2,351	114	5	6,837	0	5	59	34	2	0
14	POL	0	360	4,374	2,570	119	5	7,428	0	5	59	34	2	0
14	L-K	0	370	4,543	2,719	124	5	7,761	0	5	58	35	2	0
15	REEF	0	479	5,442	3,072	152	5	9,150	0	5	59	34	2	0
18	TZR	0	504	5,861	3,286	152	10	9,813	0	5	60	33	2	0
19	ZAP	0	567	6,230	3,376	152	15	10,340	0	6	60	33	1	0
20	NEP (e)	6	659	6,959	3,678	173	15	11,490	0	6	61	32	1	0
20	NEP (w)	6	706	7,278	3,796	178	15	11,979	0	6	61	32	1	0
21	POL	6	742	7,655	4,047	199	15	12,664	0	6	60	32	2	0
21	L-K	6	815	8,132	4,178	215	15	13,361	0	6	61	31	2	0
22	REEF	6	1,045	9,070	4,538	248	20	14,927	0	7	61	30	2	0
25	TZR	16	1,086	9,351	4,712	269	20	15,454	0	7	61	30	2	0
26	ZAP	16	1,185	10,015	4,909	280	20	16,425	0	7	61	30	2	0
27	NEP (e)	16	1,411	10,949	5,139	286	20	17,821	0	8	61	29	2	0
27	NEP (w)	16	1,506	11,294	5,229	291	20	18,356	0	8	62	28	2	0
28	POL	16	1,571	11,633	5,411	296	20	18,947	0	8	61	29	2	0

Table A-2 .--Continued.

Date	Rookery[a]	Estimated number harvested by age group						Total harvest to date	Percent harvested by age group					
		1	2	3	4	5	6		1	2	3	4	5	6
July 28	L-K	16	1,656	11,896	5,486	307	20	19,381	0	9	61	28	2	0
29	REEF	16	2,040	13,079	5,846	328	20	21,329	0	10	61	27	2	0
Aug. 1	ZAP	16	2,263	13,752	6,002	343	20	22,396	0	10	61	27	2	0
2	TZR	16	2,319	13,948	6,167	364	20	22,834	0	10	61	27	2	0
3	NEP (e)	16	2,498	14,404	6,346	389	20	23,673	0	10	61	27	2	0
3	NEP (w)	16	2,605	14,637	6,392	394	20	24,064	0	11	61	26	2	0
4	POL	16	2,660	14,791	6,457	394	20	24,338	0	11	61	26	2	0
4	L-K	16	2,710	14,865	6,457	394	20	24,462	0	11	61	26	2	0
5	REEF	16	3,047	15,587	6,644	414	20	25,728	0	12	60	26	2	0

a NEP (e) = East or Morjovi side of Northeast Point;
NEP (w) = West or Vostochni side of Northeast Point;
TZR = Tolstoi, Zapadni Reef, and Little Zapadni;
POL = Polovina, Polovina Cliffs, and Little Polovina;
ZAP = Zapadni;
REEF = Reef, Gorbatch, and Ardiguen;
L-K = Lukanin and Kitovi.

Table A-3.--Number of adult male northern fur seals counted. by class[a] and rookery section, ft. Paul Island. Alaska, 9-21 July 1983. A dash Indicates no numbered sections.

Rookery and class of male	Section 1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
Lukanin															
2	7	18	-	-	-	-	-	-	-	-	-	-	-	-	25
3	59	65	-	-	-	-	-	-	-	-	-	-	-	-	124
5	19	5	-	-	-	-	-	-	-	-	-	-	-	-	24
Kitovi[b]															
2	7(4)	6	10	14	11	-	-	-	-	-	-	-	-	-	52
3	40(17)	19	49	62	56	-	-	-	-	-	-	-	-	-	243
5	3(2)	25	8	4	61	-	-	-	-	-	-	-	-	-	103
Reef															
2	19	34	44	24	20	24	28	14	15	23	3	-	-	-	248
3	43	87	66	44	43	65	32	56	26	57	10	-	-	-	529
5	8	7	0	4	151	0	52	55	0	28	7	-	-	-	312
Gorbatch															
2	25	23	12	3	4	27	-	-	-	-	-	-	-	-	94
3	92	66	67	15	35	75	-	-	-	-	-	-	-	-	350
5	53	2	10	104	1	9	-	-	-	-	-	-	-	-	179
Ardiguen															
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	47
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Morjovi[c]															
2	16(13)	20	16	33	22	27	-	-	-	-	-	-	-	-	147
3	43(29)	59	49	63	60	40	-	-	-	-	-	-	-	-	343
5	123(13)	0	20	0	14	36	-	-	-	-	-	-	-	-	206
Vostochni															
2	17	8	13	10	6	47	38	33	20	9	6	19	33	21	280
3	54	25	43	37	30	76	60	77	53	26	41	51	117	70	760
5	57	6	4	23	62	20	18	3	29	1	2	72	40	82	419
Little Polovina															
2	22	10	-	-	-	-	-	-	-	-	-	-	-	-	32
3	18	23	-	-	-	-	-	-	-	-	-	-	-	-	41
5	106	0	-	-	-	-	-	-	-	-	-	-	-	-	106
Polovina															
2	24	8	-	-	-	-	-	-	-	-	-	-	-	-	32
3	42	27	-	-	-	-	-	-	-	-	-	-	-	-	69
5	171	47	-	-	-	-	-	-	-	-	-	-	-	-	218
Polovina Cliffs															
2	11	13	10	18	30	44	44	-	-	-	-	-	-	-	170
3	31	26	42	59	66	87	128	-	-	-	-	-	-	-	439
5	0	0	5	3	0	16	7	-	-	-	-	-	-	-	31
Tolstoi															
2	9	6	8	3	21	20	23	20	-	-	-	-	-	-	110
3	68	65	74	49	108	112	102	92	-	-	-	-	-	-	670
5	0	3	0	0	25	0	0	350	-	-	-	-	-	-	378
Zapadni Reef															
2	32	16	-	-	-	-	-	-	-	-	-	-	-	-	48
3	141	49	-	-	-	-	-	-	-	-	-	-	-	-	190
5	40	55	-	-	-	-	-	-	-	-	-	-	-	-	95
Little Zapadni															
2	3	10	11	29	23	13	-	-	-	-	-	-	-	-	89
3	24	44	68	96	55	92	-	-	-	-	-	-	-	-	379
5	5	0	0	0	0	94	-	-	-	-	-	-	-	-	99
Zapadni[d]															
2	32(0)	25	19	23	13	24	14	1	-	-	-	-	-	-	151
3	44(0)	93	104	125	77	98	85	17	-	-	-	-	-	-	643
5	26(200)	15	13	0	128	16	0	180	-	-	-	-	-	-	578

a See glossary for a description of the classes of adult male seals.
b Numbers in parentheses are the adult males counted in Kitovi Amphitheater.
c Numbers in parentheses are the adult males counted on the second point south of Sea Lion Neck.
d Numbers in parentheses are the adult males counted on Zapadni Point Reef.

Table A-4.--Number of adult male northern fur seals counted, by rookery, St. Paul Island, Alaska, July 1983.

Rookery	Date (July)	Class of adult male [a]			Total
		2	3	5	
Lukanin	14	25	124	24	173
Kitovi	14	52	243	103	398
Reef	10	248	529	312	1,089
Gorbatch	10	94	350	179	623
Ardiguen	10	14	47	2	63
Morjovi	9	147	343	206	696
Vostochni	9	280	760	419	1,459
Little Polovina	10	32	41	106	179
Polovina	10	32	69	218	319
Polovina Cliffs	10	170	439	31	640
Tolstoi	16	110	670	378	1,158
Zapadni Reef	16	48	190	95	333
Little Zapadni	18	89	379	99	567
Zapadni	21	151	643	578	1,372
Total		1,492	4,827	2,750	9,069

a See glossary for a description of the classes of adult male seals.

Table A-5.--Number of harem and idle male northern fur seals counted in mid-July, Pribilof Islands, Alaska, 1974-83. A dash indicates no data.

Year	St. Paul Island		St. George Island		Total	
	Harem	Idle	Harem	Idle	Harem	Idle
1974	4,563[a]	1,782[a]	822	481	5,385	2,263
1975	5,018	3,535	877	1,427	5,895	4,962
1976	5,324	4,041	1,093	996	6,417	5,037
1977	6,457	3,845	1,610	899	8,067	4,744
1978	6,496	3,908	1,590	1,220	8,086	5,128
1979	6,242	4,457	1,716	1,942	7,958	6,399
1980	5,490	4,248	1,563	1,795	7,053	6,043
1981	5,120	4,003	1,472	1,646	6,592	5,649
1982	5,767	4,009	1,410	1,319	7,177	5,328
1983	4,827	4,242	-	-	4,827	4,242

a Total numbers of harem and idle males in July were extrapolated from counts of harem and idle males on all rookeries in June and from counts of harem and idle males on sample rookeries (Reef, Gorbatch, and Ardiguen) in July using the following procedure:

1) Assume $\frac{\text{June (h+i)}}{\text{July (h+i)}} = \frac{\text{June (H+I)}}{\text{July (H+I)}}$, solve for July (H+I)

2) Assume $\frac{\text{July (h)}}{\text{July (h+i)}} = \frac{\text{July (H)}}{\text{July (H+I)}}$, solve for July (H)

3) Solve July (H+I) - July (H) = July (I);

where h, H = respective counts of harem males on sample rookeries and all rookeries;

i, I = respective counts of idle males on sample rookeries and all rookeries.

Table A-6.--Number of dead northern fur seal pups counted, by rookery section, Pribilof Islands, Alaska, 1983.

Island and rookery	Date (Aug.)	Section 1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
St. Paul Island																
Morjovi	25, 30	111[a]	37	22	58	34	12	-	-	-	-	-	-	-	-	274
Vostochni	26, 30	21	17	32	42	41	165	68	67	38	18	33	31	114	60	747
Little Polovina	23	17	29	-	-	-	-	-	-	-	-	-	-	-	-	46
Polovina Cliffs	23	8	71	34	58	58	79	130	-	-	-	-	-	-	-	438
Polovina	23	28	51	-	-	-	-	-	-	-	-	-	-	-	-	79
Ardiguen[b]	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33
Gorbatch	22	111	98	98	16	35	56	-	-	-	-	-	-	-	-	414
Reef	22	47	82	86	79	91	87	93	47	19	11	7	-	-	-	649
Kitovi	24	56[c]	6	52	79	30	-	-	-	-	-	-	-	-	-	223
Lukanin	24	81	90	-	-	-	-	-	-	-	-	-	-	-	-	171
Tolstoi	30	78	123	67	44	196	162	272	236	-	-	-	-	-	-	1,178
Little Zapadni	24	21	43	141	137	115	105	-	-	-	-	-	-	-	-	562
Zapadni Reef	23	120	138	-	-	-	-	-	-	-	-	-	-	-	-	258
Zapadni	25	182	131	228	112	136	108	20	8	-	-	-	-	-	-	925
															Total	5,997
St. George Island																
North	16	57	60	37	98	64	51	-	-	-	-	-	-	-	-	367
Zapadni[d]	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	124
South	16	46	47	18	-	-	-	-	-	-	-	-	-	-	-	111
East Reef[b]	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25
East Cliffs	16	70	58	-	-	-	-	-	-	-	-	-	-	-	-	128
Staraya Artil	16	141	7	-	-	-	-	-	-	-	-	-	-	-	-	148
															Total	903
														Grand total		6,900

a Includes 29 dead pups counted on second point south of Sea Lion Neck.
b No numbered sections.
c Includes 18 dead pups counted In Kitovi Amphitheater.
d Dead pups were not counted by rookery section.

Table A-7. --Number of dead northern fur seal pups counteda, by rookery, Pribilof Islands, 1974-83.

Island and rookery	1974[b]	1975	1976	1977	1978	1979	1980	1981	1982	1983
St. Paul Island										
Morjovi	-	1,765	1,829	870	606	269	508	346	348	274
Vostochni	-	3,259	3,826	2,021	1,041	573	932	889	837	747
Little Polovina	-	252	316	103	90	28	77	41	49	46
Polovina Cliffs	-	1,529	1,862	733	761	433	627	463	570	438
Polovina	-	419	378	160	151	85	127	89	97	79
Ardiguen	111	142	212	112	15	31	76	38	49	33
Gorbatch	1,188	1,025	1,341	860	475	260	699	379	399	414
Reef	1,580	1,837	2,055	1,233	593	651	790	623	654	649
Kitovi	-	787	846	331	203	171	256	187	269	223
Lukanin	-	505	385	250	197	132	206	102	139	171
Tolstoi	-	4,141	4,241	3,291	1,488	1,645	1,488	1,547	1,332	1,178
Little Zapadni	-	1,204	1,977	1,133	674	637	645	377	779	562
Zapadni Reef	-	508	638	427	129	161	243	266	276	258
Zapadni	-	3,252	3,770	2,559	1,650	1,368	1,185	1,451	1,503	925
Counted total	2,879	20,625	23,676	14,083	8,073	6,444	7,859	6,798	7,301	5,997
Estimated oversight 5%[c]	144	1,031	1,184	704	404	322	393	340	365	300
Total	3,023	21,656	24,860	14,787	8,477	6,766	8,252	7,138	7,666	6,297
St. George Island										
North	545	1,230	791	408	1,068	774	949	810	649	367
Zapadni	278	470	373	92	179	277	350	186	190	124
South	196	344	280	98	225	186	197	177	110	111
East Reef	59	102	37	60	164	104	121	74	56	25
East Cliffs	275	434	354	140	292	285	284	402	340	128
Staraya Artil	-[d]	709	454	410	590	565	484	376	315	148
Counted total	1,353	3,289	2,289	1,208	2,518	2,191	2,385	2,025	1,660	903
Estimated oversight 5%[c]	68	165	114	60	126	110	119	101	83	45
Total	1,421	3,454	2,403	1,268	2,644	2,301	2,504	2,126	1,743	948

Table A-7.--Continued.

Island and rookery	1974[b]	1975	1976	1977	1978	1979	1980	1981	1982	1983
Pribilof Islands counted total	4,232	23,914	25,965	15,291	10,591	8,635	10,244	8,823	8,961	6,900
Estimated oversight 5%[c]	212	1,196	1,298	764	530	432	512	441	448	345
Total	4,444	25,110	27,263	16,055	11,121	9,067	10,756	9,264	9,409	7,245

a The dead pups are counted after 15 August each year; most mortality has occurred by that date.

b The dead pups were counted only on selected rookeries on St. Paul Island.

c As established by survey conducted in 1960: Abegglen, C. E., A. Y. Roppel, and F. Wilke. 1960. Alaska fur seal investigations, Pribilof Islands', Alaska. Unpubl. manuscr., 165 p. Natl. Mar. Mammal Lab., Northwest and Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way N. E., Seattle, WA 98115.

d Dead pups were not counted.

Table A-8. --Soviet tags recovered in the U.S. harvest of male northern fur seals, St. Paul Island, Alaska, 5 July to 5 August 1983.

Date	Tag number	Sex	Rookery of recovery
July 5	YB 3418	M	Tolstoi
6	3M 816	M	Northeast Point
13	YM 5672	M	Northeast Point
13	3b 451	M	Northeast Point
26	YB 908	M	Zapadni
29	YB 3661	M	Reef
29	3b 3088	M	Reef
29	YM 2657	M	Reef
29	3M 1722	M	Reef
Aug. 1	XM 9799	M	Zapadni
3	YM 3034	M	Northeast Point
3	YM 3666	M	Northeast Point
4	YM 2002	M	Polovina
4	XM 8590	M	Lukanin
4	YM 3325	M	Lukanin
5	3b 129	M	Reef
5	YB 3428	F	Reef

Table A-9.--Northern fur seals entangled in fishing debris and other materials, U.S. commercial harvest of northern fur seals, St. Paul Island, Alaska, 1967-83.[a]

Year	Number of seals harvested[b]	Number of entangled seals observed on the harvesting area[b]	Percent of harvest
1967	50,229	75	0.15
1968	46,893	75	0.16
1969	32,819	66	0.20
1970	36,307	101	0.28
1971	27,289	113	0.41
1972	33,173	144	0.43
1973	28,482	137	0.48
1974	33,027	190	0.58
1975	29,148	206	0.71
1976	23,096	97	0.42
1977	28,444	99	0.35
1978	24,885	115	0.46
1979	25,762	104	0.40
1980	24,327	119	0.49
1981	23,928	102	0.43
1982	24,828	102	0.41
1983	25,768	112	0.43

a Some of these data are different from previously published tables (see Scordino, J., and R. Fisher. 1983. Investigations of fur seal entanglement in net fragments, plastic bands, and other debris in 1981 and 1982, St. Paul Island, Alaska. Unpubl. manuscr., 33 p. plus appendix. Northwest Regional Office, National Marine Fisheries Service, NOAA, 7600 Sand Point Way N.E., Seattle, WA 98115.

b Includes both sexes.

Table A-10.--Northern fur seals tagged as pups In Adams Cove, San Miguel Island, California, and the dates first observed in subsequent years at Adams Cove, 1977-83.

Tag number		Year		Date of first resighting						
Monel	Roto	Tagged	Sex	1977	1978	1979	1980	1981	1982	1983
SMI-4		1975	F	-	31 Aug.	6 Aug.	21 Aug.	-	-	-
5		1975	F	-	-	11 Aug.[b]	-	-	-	-
11		1975	M	-	-	7 July	24 May	-	-	-
15		1975	M	-	18 Aug.	28 May	-	-	-	-
16		1975	F	-	-	1 Aug.[b]	17 July[b]	-	-	-
17		1975	M	-	-	16 June	-	-	-	-
20		1975	M[a]	-	22 Aug.	12 June	22 June[b,c,d]	-	-	
21		1975	M	-	9 Aug.	-	-	-	-	-
22		1975	M	-	9 Aug.	23 June	8 Aug.	-	9 June	11 June
24		1975	M	-	9 Aug.	24 May	13 July	-	17 July	-
32		1975	M	-	-	9 June	11 June	12 Aug.	-	-
40		1975	M	-	-	9 July	-	-	-	-
41		1975	F	18 Aug.	-	-	-	-	-	-
42		1975	M	-	-	5 May	28 June	18 June	-	-
44		1975	F	-	21 Aug.	-	-	16 Aug.	-	-
46		1975	M	-	29 Aug.	-	15 July	13 July	8 July	12 July
52		1975	F	-	21 Aug.	-	-	-	-	-
54		1975	F	-	-	-	1 Aug.	-	-	-
55		1975	F	-	13 Aug.	16 Aug.	-	-	-	-
58		1975	F	-	-	24 Aug.	-	-	-	-
61		1975	F	-	22 Aug.	15 Aug.	19 July	-	-	-
63		1975	M	-	-	2 June	-	-	-	-
65		1975	M	-	-	-	25 July	-	-	-
70		1975	F	-	19 Aug.	-	26 June	4 Aug.	-	-
72		1975	F	-	1 Sept.	-	-	-	-	-
73		1975	M	-	29 July	2 Aug.	30 June	-	-	-
75		1975	F	2 Sept.	17 Aug.	27 May	10 July	-	-	-
83		1975	F	-	-	5 Aug.	14 Aug.	-	-	-
85		1975	F	-	6 Sept.	-	-	-	-	-
86		1975	M	-	17 July	18 June	-	-	-	-
89		1975	M	-	-	9 Aug.	18 July	9 July	-	-
90		1975	F	-	9 Sept.	4 Sept.	-	-	-	-
99		1975	F	-	-	8 Aug.	-	-	-	-
304		1975	M	-	1 Sept.	-	26 June	-	-	-
312		1976	F	-	-	8 Aug.	3 Aug.	-	-	-
313		1976	M[a]	-	16 Sept.	5 June	24 May	-	-	-
315		1976	F	-	-	-	14 June	-	-	-
322		1976	F	-	-	-	10 Aug.	4 Sept.	-	-
325		1976	M	-	-	-	24 May	-	-	-
328		1976	F	-	-	-	3 Aug.	-	-	-
330		1976	M	-	-	23 July	22 June	-	-	-
334		1976	F	-	-	3 Sept.	11 July[b,d]	-	-	-
344		1976	F	-	-	-	7 Aug.	-	-	-
351		1976	M	-	-	-	21 July	-	-	-

Table A-10.0-Continued.

Tag number		Year		Date of first resighting						
Monel	Roto	tagged	Sex	1977	1978	1979	1980	1981	1982	1983
SMI-368		1976	F	-	-	-	17 Aug.	-	-	-
377		1976	M	-	-	-	11 June	-	-	-
570		1976	M	-	-	-	-	-	-	24 June
615		1976	F	-	-	28 Aug.	-	-	-	-
659		1976	M	-	-	-	-	-	-	24 June
664		1976	M	-	-	-	-	-	-	31 July
678		1977	F	-	-	-	23 Aug.	-	-	-
904		1977	F	-	-	-	3 Sept.	-	-	-
908		1977	F	-	-	-	31 July	-	-	-
912		1977	F	-	-	-	19 July	-	-	-
921		1977	F	-	-	-	21 July	-	-	-
926		1977	F	-	-	-	10 Aug.	-	-	-
927		1977	M	-	-	-	31 July	-	23 June	-
928		1977	F	-	-	-	3 Sept.	-	27 Oct.	-
931		1977	M	-	-	-	7 Aug.	18 June	-	-
946		1977	M	-	-	-	10 July	18 June	-	-
956		1977	M	-	-	5 July	9 June	-	-	-
961		1977	F	-	-	15 Aug.	7 Aug.	-	-	-
962		1977	F	-	-	-	23 Aug.	-	-	-
973		1977	M[a]	-	-	-	26 July	9 June	16 June	-
977		1977	M	-	-	-	15 July	-	-	-
986		1977	M	-	-	-	-	-	17 June	-
997		1977	F	-	-	3 Aug.	30 July	-	-	-
999		1977	M	-	-	-	3 Aug.	-	-	-
1187		1978	M	-	-	-	-	9 July	-	-
1188		1978	F	-	-	-	-	26 Sept.	-	-
1189		1978	F	-	-	-	4 Oct.	-	24 Nov.	-
1200		1978	M	-	-	-	10 Aug.	18 June	-	-
1205		1978	F	-	-	-	-	6 July	-	-
1206		1978	M	-	-	-	26 July	23 July	-	-
1216		1978	F	-	-	-	-	31 Aug.	-	24 June
1217		1978	M	-	-	-	3 Aug.	18 June	-	-
1228		1978	F	-	-	-	8 Sept.	-	10 Oct.	-
1261		1978	M	-	-	-	26 July	-	-	-
1263		1978	M	-	-	-	16 Aug.	20 July	-	-
1264		1978	M	-	-	-	10 Aug.	-	4 Aug.	-
1368		1979	F	-	-	-	9 Sept.	-	-	-
1578		1979	M	-	-	-	-	-	-	-
1813[f]		1980	M	-	-	-	-	-	-	23 Sept.
1963		1980	F	-	-	-	-	-	-	24 Sept.
2021		1980	F	-	-	-	-	17 July	-	-
2031		1980	F	-	-	-	-	26 July	-	-
2065		1980	F	-	-	-	-	-	-	24 Sept.
2113		1980	M	-	-	-	-	-	12 Aug.	-
2118		1980	M	-	-	-	-	-	25 July	-
2129		1980	M	-	-	-	-	-	-	24 Sept.
2144	427[e]	1980	F	-	-	-	-	-	2 Sept.	-

Table A-10.0-Continued.

Tag number		Year		Date of first resighting						
Monel	Roto	tagged	Sex	1977	1978	1979	1980	1981	1982	1983
	429	1980	M	-	-	-	-	-	-	14 July
	435	1980	F	-	-	-	-	-	-	2 Oct.
	437	1980	M	-	-	-	-	-	-	25 July
	446	1980	M	-	-	-	-	-	-	6 Sept.
	452	1980	F	-	-	-	-	-	27 Oct.	-
SMI-2096	457[e]	1980	M	-	-	-	-	-	-	24 July
	458	1980	M	-	-	-	-	-	17 June	24 July
1977	469[e]	1980	F	-	-	-	-	-	28 Sept.	-
2005	473[e]	1980	M	-	-	-	-	-	7 Sept.	-
	486	1980	F	-	-	-	-	-	7 Sept.	-
	487	1980	F	-	-	-	-	-	18 Sept.	-
2072	488[e]	1980	F	-	-	-	-	-	21 Sept.	-
	491	1980	F	-	-	-	-	-	-	9 July
	651	1980	M	-	-	-	-	-	10 Sept.	-
2511	735[e]	1981	F	-	-	-	-	-	19 Oct.	-

a Mistakenly identified as a female and tagged on the left flipper.
b Observed nursing a pup of the year.
c Tag recorded as being floppy and/or reversed in flipper at least once.
d Pup was used In growth study.
e Double-tagged.
f Tagged at Castle Rock.

Table A-11 .--One hundred northern fur seal pups double-tagged with monel (SMI) and pink Roto (A) tags at Adams Cove, San Miguel Island, California, on 26 September 1983. Monel tags were attached to the right foreflippers of males and the left foreflippers of females. Pink Roto-tags were attached to the right foreflippers of females and the left foreflippers of males. All -seals were checkmarked by removal of the cartilaginous extension of the fifth digit on the right hind flipper.

Tag number				
Monel	Roto	Sex	Weight (kg)	Remarks
SMI-3001	A-201	M	6.5	
3002	202	M	5.0	
3003	203	M	5.5	
3004	204	M	5.0	
3005	205	F	4.5	
3006	206	M	7.5	
3007	207	F	6.5	
3009	209	F	7.0	
3008	208	F	5.0	
3010	210	F	4.5	
3011	211	F	4.5	
3012	212	F	5.5	
3013	213	M	5.5	Tag close to edge of flipper
3014	214	M	9.5	
3015	215	M	7.0	
3016	216	M	5.5	
3017	217	F	7.0	
3025	218	F	9.5	
3019	219	M	8.0	
3018	220	M	5.0	
3020	221	F	6.0	
3021	222	F	5.0	
3022	223	F	5.0	
3023	224	F	5.0	
3024	225	M	7.0	
3026	226	F	6.5	
3027	227	M	9.0	
3028	228	F	5.5	
3029	229	F	5.5	
3030	230	M	10.0	
3031	231	M	10.0	
3032	232	M	7.0	
3033	233	M	6.5	
3034	234	M	5.0	
3035	235	F	5.0	
3036	236	F	5.5	
3037	237	F	6.0	

Table A-11 **.--Continued.**

Tag number		Sex	Weight (kg)	Remarks
Monel	Roto			
SMI-3038	A-238	M	6.5	
3039	239	F	6.5	
3040	240	M	6.5	
3041	241	F	5.5	
3042	242	F	8.0	
3043	243	M	6.5	
3044	244	F	7.5	
3045	245	F	7.0	
3046	246	M	8.0	
3047	247	F	6.0	
3048	248	M	6.5	
3049	249	F	5.0	
3050	250	M	7.5	
3051	251	F	5.5	
3052	252	F	6.0	
3053	253	F	5.5	
3054	254	M	6.0	
3055	255	F	6.5	
3056	256	M	8.0	
3057	257	M	5.5	Tags reversed
3058	258	F	6.5	
3059	259	M	8.5	
3060	260	M	8.0	
3061	262	F	6.0	
3063	263	M	6.5	
3064	264	M	8.0	
3065	265	M	5.0	
3066	266	F	7.0	
3067	267	F	5.0	
3068	268	F	6.0	
3069	269	M	6.0	
3070	270	F	5.0	
3071	271	F	6.5	
3072	272	M	6.0	
3073	273	M	7.5	
3074	274	M	8.0	
3075	275	F	8.0	
3076	276	F	7.0	
3077	277	M	8.5	
3078	278	F	6.5	
3079	279	F	7.0	
3080	280	F	7.0	
3081	281	M	7.0	

Table A-11.-- Continued.

Tag number				
Monel	Roto	Sex	Weight (kg)	Remarks
SMI-3082	A-282	M	8.5	
3083	283	F	7.0	
3084	284	M	7.0	
3085	285	M	7.5	
3086	286	F	9.0	
3087	287	F	10.5	
3088	288	F	8.0	
3089	289	F	7.5	
3090	290	F	6.0	Tag close to edge of flipper
3091	291	M	7.0	
3092	292	M	8.5	
3093	293	F	5.0	
3094	294	F	5.5	
3095	295	M	7.0	
3096	296	M	8.5	
3097	297	M	7.0	
3098	298	M	6.5	
3099	299	F	5.0	
3100	300	F	5.0	
3062	782	F	7.5	Double-tagged with monel tags only
		M	6.0	
		F	7.0	
		F	7.0	
		M	5.0	

Table A-12. --Northern fur seal females double-tagged with white plastic Roto-tags in Adams Cove, San Miguel Island, California, on 18 November 1979, and dates first resighted, 1980-83.

Tag number[a]			Date resighted[b]			
Right flipper	Left flipper	Vibrissae color[c]	1980	1981	1982	1983
401	402	white	23 July*	6 July*	-	-
404	403	mixed	10 Aug.*	5 July*	19 Nov.	-
405	406	white	5 July*	5 July	3 Nov.*	-
407	408	white (tag lost, right side)	-	-	-	-
410	409	white	1 July*	18 June	17 Sept.	-
411	412	white	6 July**	-	18 Oct.*	-
413	414	mixed	5 July	15 July	1 Sept.	-
416	415	white	21 June**	11 July	17 June*	-
417	419	white	5 July*	23 July*	29 Sept.	-
420	421	white	4 July	9 July	4 Nov.*	-
422	423	white	18 July*	15 July	2 Sept.	15 July
424	425	white	15 Aug.	19 July	3 Sept.	-
426	427	white	27 June*	6 July*	11 July*	19 June
428	430	white	21 June*	6 July*	29 June*	-
431	432	white	29 July	12 Aug.	10 Sept.*	-
433	434	white	29 July	13 Aug.*	17 July	-
435	437	white	2 June	18 June	-	-
438	439	white	5 July	20 June	2 Sept.	-
440	441	white	5 July*	15 July	2 Oct.	-
442	443	mixed	18 June*	23 July	22 Aug.*	-
445	444	mixed	23 July	-	22 Aug.	-
447	446	white	6 Sept.	29 June**	9 Sept.*	-
448	449	white	Died 16 Aug., due to cliff collapse, right-side tag lost.			-
450	451	white	28 June*	24 June	23 June*	-
452	453	white	-	-	-	-
454	455	white	-	-	-	-
456	457	white	-	-	25 July*	-
458	459	white	21 June	23 Sept.[d]	-	23 July
460	461	white	13 Aug.*	-	-	-

a Tags destroyed: 418, 429 and 436.

b "*" indicates the female was known parturient that year and "**" indicates the pup was stillborn or died shortly after birth.

c Mixed = combination of black and white.

d Resighted on Castle Rock.

Table A-13.--Northern fur seal males, double-tagged at Adams Cove with pink (P) Roto, monel (M) on 24 May 1981 or with white (W) Roto-tags on 1 May 1981, and dates first resighted, 1982-83.[a]

Tag number		Age[b] (years)	Date resighted	
Right flipper	Left flipper		1982	1983
SMI-659(M)	426(P)	3-4 (e)	-	25 July
465(W)	464(W)	3-4 (e)	6 July	-
466(W)	SMI-1211(M)	3 (a)	4 Aug.	20 June
468(W)	467(W)	3-4 (e)	-	-
470(W)	469(W)	3-4 (e)	17 June	-

a Some fur seals had been tagged previously as pups with different tag types and number series.

b (e). = estimated age;
(a) = actual age.

Table A-14.-- Ninety-seven northern fur seal pups double-tagged with monel. (SMI) and pink Roto (C) tags on Castle Rock, San Miguel Island, California, on 25 September 1983. For the first 68 pups, monel tags were attached to the right foreflippers of males and the left foreflippers of females. Pink Roto-tags were attached to the right foreflippers of females and the left foreflippers of males. The last 29 pups were tagged with monel tags only. All seals were checkmarked by removal of the cartilaginous extension of the fifth digit on the right hind flipper.

Tag number		Sex	Weight (kg)	Remarks
Monel	Roto			
SMI-2875	C-153	F	5.0	
2876	154	F	6.0	
2877	155	F	5.5	
2879	157	M	4.5	
2878	156	F	5.0	Tags reversed
2880	159	F	4.0	
2900	158	M	7.0	
2881	160	M	9.5	
2882	161	F	6.0	
2883	162	M	5.5	
2884	163	M	7.0	
2885	164	M	4.5	
2886	165	M	7.0	
2887	166	F	6.5	
2888	167	M	4.0	
2889	168	F	5.0	
2890	169	F	4.0	
2891	170	F	5.0	
3000	171	F	7.0	
2892	172	F	5.0	
2893	174	F	5.0	
2894	173	F	8.0	
2895	175	F	7.5	
2897	177	M	8.0	
2896	176	F	5.5	
2898	178	F	4.5	
2899	179	F	5.0	
2901	180	F	5.5	
2902	181	M	6.0	
2903	182	M	5.5	
2904	183	F	5.5	
2905	184	M	7.5	
2906	185	M	6.0	
2907	186	F	6.5	

Table A-14. - - Continued.

Tag number		Sex	Weight (kg)	Remarks
Monel	Roto			
SMI-2908	C-187	F	6.0	
2909	188	F	6.0	
2910	189	M	8.0	
2911	190	F	6.5	
2912	191	M	5.0	
2913	192	F	7.0	
2914	193	M	5.5	
2915	194	M	4.0	
2916	195	M	7.5	
2917	196	F	5.0	
2919	197	F	6.5	
2918	198	F	7.5	
2920	199	M	8.0	
2921	200	M	8.0	
2922	201	M	7.5	
2923	202	F	6.5	
2924	203	F	6.5	
2925	204	F	4.5	
2926	205	M	8.0	
2927	206	F	5.5	
2928	207	F	6.0	
2929	208	M	8.5	
2930	209	M	7.0	
2931	210	F	6.5	
2932	211	F	6.5	
2933	212	F	8.0	
2934	213	F	8.0	
2935	214	M	6.5	
2936	215	F	5.5	
2937	216	M	7.0	
2938	217	M	6.5	
2939	218	F	8.0	
2940	219	F	7.5	
2941	220	M	7.5	
2942-2943		M	6.5	
2944-2945		F	7.5	
2946-2947		F	6.5	
2948-2949		F	7.0	

Table A-14.--Continued.

Tag number		Sex	Weight (kg)	Remarks
Monel	Roto			
SMI-2950-2951		F	5.5	
2952-2953		F	7.0	
2954-2955		M	9.0	
2956-2957		F	7.5	
2958-2959		M	9.0	
2960-2961		M	8.0	
2962-2963		M	9.5	
2964-2965		M	7.0	
2966-2967		M	9.5	
2968-2969		M	7.0	
2970-2971		M	8.0	
2972-2973		M	6.5	
2974-2975		M	9.0	
2976-2977		F	5.0	
2978-2979		F	6.0	
2980-2981		F	5.5	
2982-2983		M	8.0	
2986-2987		F	5.0	
2985-2984		M	7.0	
2989-2988		F	5.5	
2990-2991		M	6.4	
2994-2995		M	6.0	
2992-2993		F	7.0	
2996-2997		F	7.0	
2998-2999		F	7.0	
		F	8.0	No tags applied
		M	6.5	No tags applied
		M	5.0	No tags applied
		F	5.5	No tags applied
		M	8.0	No tags applied
		M	6.0	No tags applied

APPENDIX B

Scientific staff engaged in northern fur seal research in 1983

National Marine Mammal Laboratory (FMML)
Michael F. Tillman, Director
Robert V. Miller, Deputy Director
Charles W. Fowler, Manager, Fur Seal Program

Name	Affiliation	Assignment
Permanent		
Patrick Kozloff	NMML	Population Assessment
Roger L. Gentry	NMML	Behavior and Biology
Robert L. DeLong	NMML	Behavior and Biology
George A. Antonelis, Jr.	NMML	Behavior and Biology
Mark C. Keyes	NMML	Veterinary Medical Services
Hiroshi Kajimura	NMML	Pelagic Ecosystem
Anne E. York	NMML	Population Dynamics
Temporary		
Michael E. Goebel	NMML	Behavior and Biology
Kathlene Newell	NMML	Behavior and Biology
Wendy Roberts	NMML	Behavior and Biology
E. Dave Thielk	NMML	Behavior and Biology
Kathryn Chumbley	NMML	Behavior and Biology
Paul Morley	NMML	Behavior and Biology
George Zacharof	NMML	Population Assessment
M. Robert Kochergin	NMML	Population Assessment
Alfey L. Hanson	NMML	Population Assessment

APPENDIX B (Continued)

Name	Affiliation	Assignment
Igor V. Melovidov	NMML	Population Assessment
Charles A. Melovidov	NMML	Population Assessment
Myron A. Melovidov	NMML	Population Assessment
Laurie Briggs	NMML	Population Assessment
Lavrenty Stepetin	Pribilof Isl. Prog.	Population Assessment
Cooperators[a]		
Thomas R. Loughlin	NMML	Pelagic Studies
Douglas DeMaster	SWFC[b]	Pup Tagging Project
Larry Hansen	SWFC	Pup Tagging Project
Sandra Hawes	SWFC	Pup Tagging Project
Dana Seagars	Southwest Regional Office	Pup Tagging Project
Brent Stewart	Hubbs Res. Inst., San Diego, Calif.	Pup Tagging Project
Doyle Hanan	Calif. Dept. Fish. Game	Pup Tagging Project
Kazumoto Yoshida	Far Seas Fish. Res. Lab., Japan	Fur Seal Entanglement
Yasutoshi Fujimaki	Izu-Mito Sea Paradise, Japan	Fur Seal Entanglement
Marianne Tomita	Pribilof Isl. Prog.	Fur Seal Entanglement

a Financed wholly or in part by the National Marine Mammal Laboratory or other federal agency.

b Southwest Fisheries Center, National Marine Fisheries Service, NOAA, P.O. Box 271, 8604 La Jolla Shores Drive, La Jolla, CA 92038.